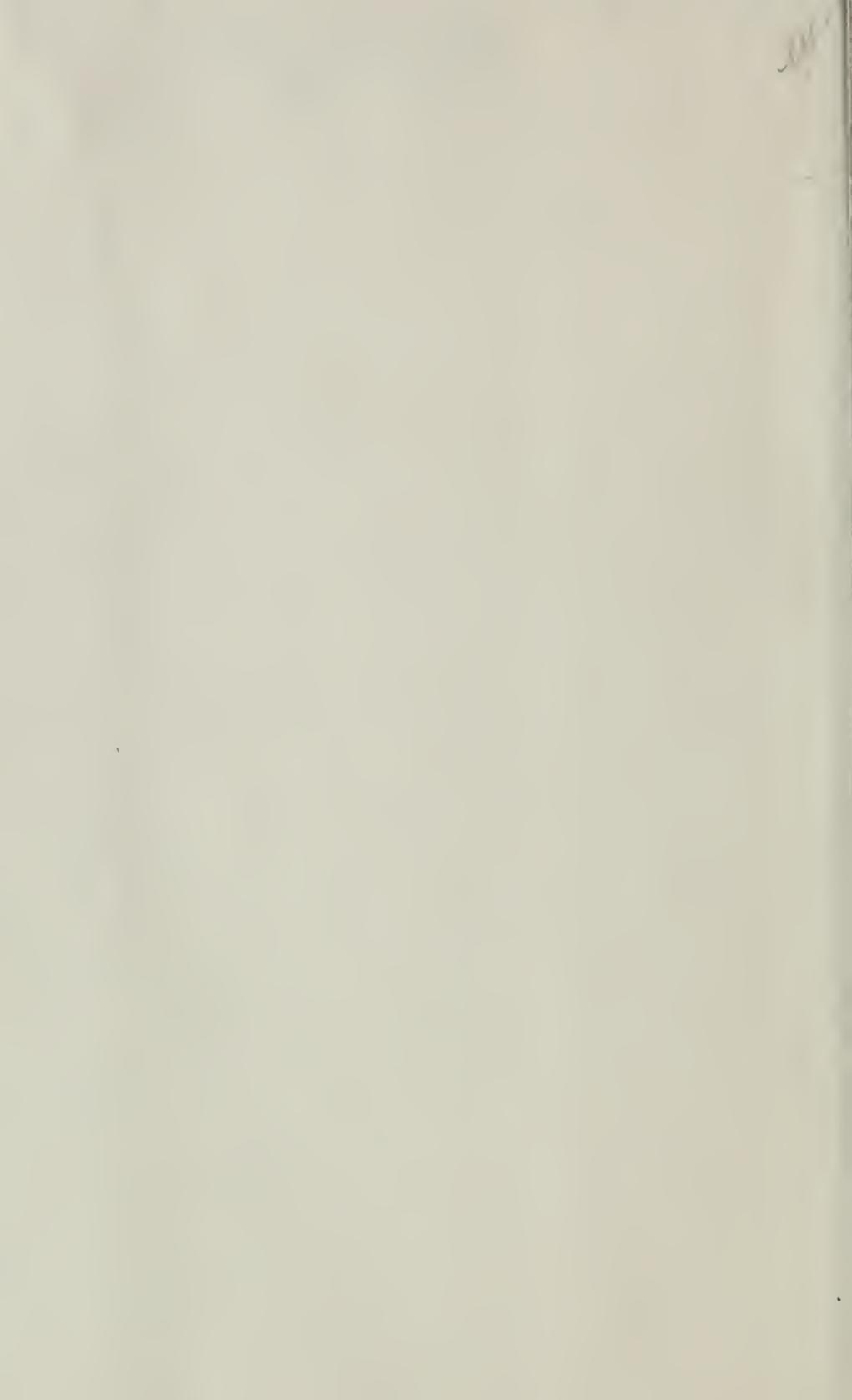


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THE LANGUAGE OF COLOR

BY
MAY 18 1967
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and Their Applications," "The Lighting Art"



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THE LANGUAGE OF COLOR

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COLOR AND ITS APPLICATIONS (1915).

360 *Pages, 129 Illustrations, 21 Tables, and 4 Color Plates.*

LIGHT AND SHADE AND THEIR APPLICATIONS (1916).

277 *Pages, 135 Illustrations, 10 Tables.*

THE LIGHTING ART (1917).

229 *Pages, 43 Illustrations, 9 Tables.*

THE LANGUAGE OF COLOR (1918).

TO
MY WIFE

PREFACE

There is evidence on all sides of a lack of correlation of the sciences and the arts which doubtless is due to the difficulty an individual encounters in adapting himself to these two viewpoints. [For the benefit of his art, the artist should acquaint himself with the general sciences upon which his art is founded; and for the benefit of progress the scientist should bear in mind the viewpoint of the artist. There should be no misapprehension regarding the relation of science and art because the former supplies the enduring foundation for the latter.] For this reason it appears that those who primarily possess a scientific viewpoint should attempt to bridge the gap by laying their course upon facts. It is with this attitude that I have attempted to present a brief review of the language of color in which its present status, and the foundation upon which its future must be established, are discussed.

[No subject has been more abused than Color by those possessing only a superficial knowl-

edge of the underlying scientific principles; therefore, there is a need for presentations of the facts of various aspects of color.) The subject of this book is very extensive in scope for it includes not only various sciences but also many arts. Brevity of treatment was essential in order to present a concise review of the subject and it has appeared the better plan at this time to present merely a review as suggestively as possible. The goal which I have kept in mind is the possibility of an ultimate art purely of color or at least of an extension of the present use of the expressiveness of color. Such an aim can only be realized by interpreting our present language of color, by extending this knowledge by further study and experiments, and by making the understanding of the expressiveness of color a general accomplishment of mankind.

It will be noted that in dealing with those aspects of color which are only vaguely understood the discussion does not depart far from the known scientific facts which appear to be associated with the future development of these aspects. On the whole, this brief treatise aims to correlate the science and art of the expressiveness of color in a fundamental manner. It is hoped that this rudimentary "dictionary" of

the language of color is a forerunner of a more extensive discussion which may appear in later years if the developments are sufficient to warrant it. Regardless of the future, it appears that the effort has been well spent if it has yielded no more than a correlation of some of the data of the sciences and arts of color. My viewpoint is more comprehensively discussed in the first chapter which is in reality a preface to be read and in the last chapter which points toward the future.

I take pleasure in recording my appreciation of the opportunities afforded by the management of the National Lamp Works of General Electric Company for prosecuting various studies and of the courtesies extended by Dr. E. P. Hyde, director of the Nela Research Laboratory.

M. LUCKIESH

Oct. 31, 1916

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PART I

Rock - B.M.

THE LANGUAGE OF COLOR

INTRODUCTION

PROLONGED intimacy with color, either in its science or art, doubtless has always aroused and stimulated thought and speculation regarding its effects upon the human organism. In fact, it is one of the aims of the artist to discover the powers of colors and to employ their suggestiveness in his appeals to emotional man. In this respect our final interest in the use of color, as in many other activities, is largely concerned with the psychological effects. In other words, the ultimate object of the various arts lies largely in their influences upon human consciousness. It would be an interesting study to explore the maze of devious highways traversed by that evolving something which is an emotion in the making but this is a field for the psychologist. Investigators in psychology are invading this vast unknown and from this angle it is hoped that our knowledge of the emotional effects of color will some day be greatly extended.

It is the object in this brief work to explore

various fields in which color is used, to attempt to sift out the part played by color in arousing emotions and in portraying ideas, and to present discussions and suggestions regarding the possibility of a future art purely or predominantly of color. The wonderful gift of color-vision has made it possible to touch the emotional side of the human organism through color in Nature and through the use of color in such arts as painting, architecture, literature, dancing, and the drama. Exhaustive research in these various fields is not entertained at present but it is the hope that the following brief discussions, combined with a study of color in nature and with the meager data supplied by the physiologist and psychologist, will illuminate the pathway toward a rudimentary dictionary of the language of color.

It would be unscientific to deny the existence of a language of color because we do not understand it thoroughly at present and quite unprogressive to reject the possibility of finally completing the dictionary of this language. Color experiences are indeed very intricate at present but it is likely that this is due to our scanty knowledge of the elements and processes involved in the emotional appeal of colors, and to our inability to interpret and to correlate

properly the various factors. Much knowledge must be unearthed before a rudimentary dictionary of this language is available but first the scientific attitude should admit the possibility that the language of the group of experiences associated with color eventually will be understood. Directly and indirectly we have occasional glimmerings of understanding but the data which must build the foundation of this dictionary are meager indeed. It must be sought in many indirectly related activities of man, the emotional aspects of which are at best only faintly understood. When it is considered that most of the knowledge of the expressiveness of color must be sought in these various activities whose allegorical, representative or emotional powers are more or less obscure, it would be presumptuous to expect to emerge from the final chapter of this book with an unabridged dictionary of the language of color. Therefore, no greater result is expected than a correlation of the various viewpoints and sources of information which may serve as a preliminary analysis of present knowledge of the subject. At least it is hoped that fruitful trends of thought and investigation and various extensions of the application of color will be made apparent.

In the arts, color has not yet played a solo part. It has been merely an element in the ensemble, but even in this minor rôle its influence appears to be positive though difficult to analyze. Instead of being merely an element in an ensemble, is it not possible, when its language is understood, that there will have evolved an art purely, or at least predominantly, of color, which, in order to be interpretable, will require little or no assistance from line, form, subject, words, rhythmic sounds or movements? The chief object here is to record results of excursions into the various fields, including arts and sciences, and to discuss briefly the meager, available data which contribute toward a language of color. However occasionally, by drawing upon intimacies gained through direct interest and contact with the artistic and scientific aspects of color, the author will venture suggestions and possibly a few predictions, with the object of hastening, doubtless ever so slightly, the possible advent of such an art or at least the extension of the use of color. Experiments, observation and study must be relied upon to supply the foundation and to enlarge the dictionary of the language of color so that, eventually, a language, crude though it may be in the begin-

ning, may form a broader foundation for a working knowledge of the emotional possibilities of color. If it appears to some that the subject treated here is outside the realm of the scientist in the field of color, the defense offered is that this book is not dealing with a recognized existing reality but with a possible futurity. Furthermore, the foundation of all arts is science, and definite progress will best result from a scientific analysis of the available knowledge and from two perspective views, one backward and the other forward.

Color in a broad sense includes light and shade and is synonymous to light. In all interpretations, difficulties arise from the unfortunate indefiniteness, and consequent looseness, of the nomenclature of color. Ofttimes throughout this study and discussion it has been necessary to interpret a vague description or use of color, and it is recognized that these instances provide opportunities for different opinions. Furthermore, all the data recorded in the following chapters are not considered conclusive, and the author does not necessarily commit himself to a complete accord with many of these symbolical uses of color by the act of incorporating descriptions of them. The material has

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been carefully selected and recorded because of its possible value and has been condensed for the sake of interest and clarity.

Not the least incentive in presenting this brief work has been the desire to illustrate the difference in the value of material of this character, which has at least some semblance of a sound foundation of fact, and that which springs from pure imagination. It is not unusual to hear the scientist—the searcher after facts, the analyst who not only aims to discover truths but to learn their relations to each other—accused of a lack of imagination. It is quite consistent that the accusers are usually possessed of abnormal imaginations which dominate or smother that which furnishes the ties to this world of accepted facts. They have little respect for accepted facts but a relatively much greater regard for the products of their imaginations. Ofttimes they are neither adequately versed in science nor sufficiently analytical to discern the difference between that which *is* fact in the ordinary sense and that which they *think* is fact. This is simply illustrated in the foregoing accusation because it has been imagination that has led the scientist to discoveries. The difference between the scientist and the ultra-imaginative is that the former does not permit his

imagination to carry him away from the base of facts without maintaining lines of communication, while the latter soars serenely into the unknown, feeling secure in a world that exists only in his imagination. Nothing can harm him because he is invulnerable to facts and his imagination can create protective expedients at will. To be safe, the possibility may be admitted that perhaps each individual's world only exists in his imagination, however, for the everyday business of life there is a striking similarity among most of the individual "worlds" regarding that which we call fact.

It is true that much of the progress of civilization has been due primarily to radicals, but the blind imaginings of radicalism aid in progress only by stimulating controversial activity or by mere accident. Moderate imagination which does not carry the individual too far from the base of accepted facts is helpful to progress, but an excessive amount hinders progress by the wasting of energy in controversy. It is not the intention to disparage the value of sane imagination which does not blind the individual to the value and necessity of discovering and organizing facts. However, it is likely that no subject has been abused more than *Color* because its effects are so vaguely understood that the ma-

jority of persons are inclined to hearken to the sayings of the ultra-imaginative with more or less credulity. Examples of the harmful effects will be glimpsed occasionally in the following chapters.

(It is the object in this brief work to record some of the impressions colors have made upon the human organism.) In doing so, as already stated, the author does not necessarily commit himself favorably or unfavorably, for the very good reason that he appreciates the limitations of the impressions of colors upon a single mind. Impressions are closely dependent upon associations and the latter are individualistic to a certain degree, owing to their intimate dependence upon the past experiences of the individual, so that single minds can hardly be expected to be impressed entirely alike. However, colors apparently have some definite attributes almost universally recognized, and it is reasonable to expect that a possibility exists for a more or less definite language of color to evolve from this common beginning through continued cultivation.) The ultimate language of color will be that which arises from the common consent of a great percentage of intellects developed under similar adaptations, but science must organize this art before much progress can be made, just

as it did in the case of music. Music as a science is in advance of the fine arts, its most essential principles being expressed mathematically; however, no scientist entertains the belief that he can rival Mozart in the composition of music by virtue of his mathematical skill alone. Such is also the viewpoint of the scientist regarding an art purely of color, and by the foregoing precedent and others he is freed from criticism if he entertains the idea that it is his work to organize the art.

It is with this attitude that this present chaos of color expression is invaded. Besides recording impressions and symbolical uses of color gleaned from many diversified sources, some discussions of various aspects of the subject will be indulged in. In the latter there are opportunities for other opinions and conclusions, but in dealing with a subject of which only fragmentary and, at best, only rudimentary facts are positively known and of whose future we can do little more than to conjecture, a feeling of security is entertained inasmuch as accepted facts have formed the foundations. There appears to be a sufficient number of facts available to warrant the belief that a discussion of the possibilities of a language of color will be of value at the present time. Furthermore, it

appears from the apparently consistent uses of color in the past and from the trends at present that this brief record and discussion will aid in laying a foundation for an ultimate art purely or predominantly of color, if future developments prove that the human organism can adapt itself to an understanding of such an art. This possible art will appeal to us through the language of color and its development will require experiments directed by sane imagination which is resigned to a work extending for years and perhaps for generations.

MYTHOLOGY

"I feed the clouds, the rainbows, and the flowers
With their ethereal colors."

—SHELLEY: "Hymn of Apollo."

IN order to begin with a comprehensive view of the subject, the more important sources of information will be briefly reviewed. Chronologically, one of the first sources is found beyond the outskirts of recorded writing, in the more or less vague imaginings of mythology. This subject provides an interesting introduction into the study of the language of color and also glimpses of the impressions that light and color have made upon the intellects of the early peoples. Furthermore, the crystallization of these impressions into the permanent and recognized usage of the present time can be readily witnessed and understood. Colors have played a conspicuous part in mythology. Doubtless the attributes which they are supposed to possess were very real to many but even though it were originally realized that the colors were used symbolically through mere fancy, they have acquired, by continued association and common consent, some degree of signification similar to words.

It is impossible to separate the treatments of color in mythology and in symbolism because the use of colors in mythology is largely symbolical. Much of the color has been inserted by artists and writers centuries after the myths had evolved to a more or less stable state. At this point it appears desirable to discriminate between fable and mythology. The former is a story in which characters take part in a plot and no pretense to reality is entertained. It is a narrative in which beings, sometimes irrational or inanimate, are feigned to perform as human beings. Myths are stories of anonymous origin prevalent chiefly among primitive peoples and accepted by them with credulity. Natural phenomena and various events are accounted for by attributing them to the supernatural. According to Jonson,

"Fables are vessels made to order into which a lesson may be poured. Myths are born, not made. They owe their features to the imaginative efforts of a generation of story-tellers."

When the origin, purpose, and life of myths are considered, a view is obtained of the importance of a symbolic use of color which has survived during the long and devious process passed through by a myth during its evolution.

The power of association of color with a certain event for years is exemplified in many cases at the present time and, therefore, the symbolical use of color in mythology should not be rejected. Many of these symbolical uses of color in mythology, art, and language have become deeply rooted and have their places in the language of color as firmly established as words in a dictionary of spoken language.

(Many of the commonplace facts and fables preserved from generation to generation, though perhaps altered by fancy from time to time, form a considerable portion of the material of literature and of the representative arts. Sculpture was the finest art of the ancient Greeks and, perhaps for this reason, color is not as conspicuous in their mythological representations as it doubtless would have been if the art of painting had reached a higher state of development during that early period.) A complete inquiry into these symbolical uses of color would require exhaustive research because of the haziness of interpretations and of the extensiveness of the field which includes all of the pure and applied arts in which color is employed. The indefiniteness of color terminology and notation causes difficulties in attempting to interpret data rescued from obscurity.

Endless complications arise owing to the varying interpretations of the countless personalities involved. To do this subject justice would require years of research in the arts, traditions, and mythology of many peoples of all ages. Frankly, this has not been attempted, and it is doubtful if the fruits of such an effort would be sufficiently valuable in contributing toward a language of color to justify the expenditure of such an effort at present. However, sufficient data of this character have been obtained from which to forge a link in the chain of evidence and some of this material is presented in various chapters especially in those dealing with the symbolism of colors.

We would gain more valuable data from the early writings, which were largely a record of myths, if color-names had been more definitely developed in those early periods. In fact, the scarcity of color-names especially those for blue and green, makes it necessary to interpret various meanings which in many cases can be no more certain than mere speculation. Some of the early Greek myths which form the basis of excellent literature, such as the Iliad and Odyssey, are quite lacking in definite color-names especially for some colors. The Vedas contain many descriptions of the sky in all of its vari-

ety of moods, but Geiger says, "the fact that the sky is blue could never have been gathered from these poems by any one who did not already know it himself." The sky or heaven also plays a prominent part in the Bible, occurring in the first verse and in no less than four hundred other passages, yet the blue color is not mentioned. Geiger also states that "the ten books of Rigveda hymns, though they frequently mention the earth, no more bestow upon it the epithet 'green' than on the heaven that of 'blue.'" In many early writings no name for yellow appears.

Notwithstanding this paucity of color-names there can be no doubt that the colors of such abiding places of gods, mysteries, etc., as the sky, the earth, and the sea, impressed those beings of early history. In many cases it is a simple task to supply the color-name and to interpret the part that color played in the superstitions and myths of these beings. Many of the characteristics which are bestowed upon colors at the present time owe their origin to the imaginings of early peoples who lived at a period when knowledge was too scanty to curtail, to any appreciable extent, the fancies of these children.

Much color has been introduced into mythol-

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ogy and mythological representations by ecclesiasts, artists, and story-tellers of more recent periods and these also add their influence in molding the language of color.) Here and there throughout this book the influence of mythology will be discerned.

ASSOCIATION

ISOLATED mental processes which become related to each other, but not blended sufficiently to lose their identity, are said to be associated and these relations are termed "associations." An attempt to explain the mental mechanism of association doubtless would prove futile even after having devoted considerable space to the discussion because psychologists are not universally in accord with any hypothesis or theory. Association has been a powerful factor in the development of our rudimentary language of color for in many cases the continued associations of colors with certain events, things, sensations, ideas, or emotions have resulted in accepted significations of those colors and the associations no longer are apparent or necessary. In fact, (all of our experiences are the results of an intermingling of a vast complex of associations. The entire history of a human being consists of endless chains of associations traceable far back into the early periods of infancy.) Where associations begin to mold the development of the human organism and to influence the mind, it is difficult to

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state. Doubtless they begin with the beginning of what we term experience.

Associations are of many degrees of intimacy varying from those in which the components are almost completely blended to those of lesser intimacy in which experiences are merely linked. They are of far-reaching influence in the mental life of mankind and perhaps it is safe to state that, as far as result is concerned, the associations are chiefly of the former or very intimate type because relatively few persons are, under ordinary circumstances, sufficiently analytical to diagnose them. For the present purpose, and even for the ultimate application of a language of color, this latter point is of interest because, fortunately, any language, whether it be literature, music, painting, or sculpture, is largely successful because of the fusing of the individual elements to a considerable degree. One loses much of the joy of the normal appeal of these arts if he be continually awaiting with critical or analytical attitude.

It is of interest to note here that psychologists tell us that the probability of the occurrence of a certain mental state or act due to a certain situation is dependent upon the "frequency, recency, intensity, and resulting satisfaction of its connection with that situation or

some part of it and with the whole frame of mind in which the situation is felt." Association of colors with certain things, events, ideas, sentiments, and emotions, that is, with certain experiences, has formed a rudimentary foundation of a language of color.] It may doubtless contribute much toward the completion of the structure. In fact, the very nature of learning, or the cultivation of the intellect, is largely, if not wholly, a matter of association. It is true that many of the rudiments of a language of color are likely to come originally from various sources but prolonged association, that is, continued practise, must be the means of standardizing this possible art.

(The power of continued association of colors with certain things or experiences can be illustrated in a great many instances. A few simple cases will be mentioned in order to emphasize this aspect in respect to the expressiveness of color so that this influence will be borne in mind in any uses of color in this manner. In fact, few uses of color are free from this influence and many wrong conclusions are arrived at by not recognizing its importance.) For instance, in the field of lighting—of interest to very civilized beings—artificial light is traditionally of a yellowish or "warm" color. The

habit arising from this association, throughout many generations, of a yellow-orange tint with the light from such sources as the camp-fire, the grease lamp, the tallow candle, the kerosene flame, and the electric incandescent lamp is so deeply rooted that discussions of lighting are sometimes faulty owing to a lack of realization of this influence. The habit is so firmly established that usually it is not recognized as habit. For example, it is not uncommon for persons to attribute various physiological effects due to the "white" light from a tungsten lamp (which really is not even a near approach to white) whereas these persons and millions of others and their ancestors since the beginning of man have lived uncomplainingly under natural daylight for a much greater percentage of their conscious hours. Inasmuch as the tungsten light is very yellowish in color as compared with daylight it is almost needless to state that the logic is defective when physiological disturbances are attributed to the "whiteness" of the artificial light if these same disturbances are not experienced in natural daylight.

Turning to a few simple associations of color one of the most common is the signification of red for danger. Of course, environment determines the interpretation of the significance

of a color as it does of other experiences, but it is unnecessary to discuss this matter here.] The fact remains that red in its proper environment is unmistakably a signal for danger and that the color is the important element in effecting the deduction. [Red is also readily associated with blood and its expressiveness partakes of the effects of such association.]

[Yellow or orange is often significant of light and warmth due to the association of this color with the sun or with sunlight. Again, analysis proves that sunlight is far from this color except when altered at sunrise or sunset by the absorption of smoke, dust, etc., in the excessive thickness of atmosphere through which the light must penetrate when the sun is at low altitudes. By contrast with blue skylight the light from the sun appears of a yellowish color and doubtless this effect of contrast has played a great part in attributing a yellow tint to sunlight.] Direct sunlight during a great portion of the day apparently has a just claim to being white in color although there is no general agreement as to a standard white. Physicists, at least, do not generally consider noon sunlight on a clear day of a yellow tint and some physiologists and psychologists consider it to be bluish in color as compared with a true "physiological" white.

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However, the sun does appear yellowish by contrast with the blue background of clear sky and this is the fact that is of importance here. Likewise a sunlit cloud appears yellow by contrast with the adjacent patch of clear blue sky and a sunlit surface usually appears as though it were illuminated by a yellowish light because of the contrast with the cold bluish color of shadows which receive chiefly the bluish light from the sky. These are excellent illustrations of the difference between that which *is* and that which *appears* to be.

[Green is the most conspicuous garb of nature, and thus represents life.] Perhaps because of its freshness or newness in springtime, it is associated very much with this season and, from analogy, there have arisen many metaphorical uses of green symbolizing youth, immaturity, and the early stage of any career. Adaptation of the eye predominantly to this color may be responsible for the neutrality of green. (It is neither warm nor cold, but restful, and its symbolic uses sometimes reflect the influences of such associations.)

→ [The earliest associations of blue were doubtless with the sky or heavens and it logically assumes a divine significance.] A clear blue sky of summer is the acme of serenity and we ar-

not surprised to find this color endowed with a corresponding attribute.] There are periods, especially toward nightfall, when the color of the sky approaches a darker shade of blue. The quietude of approaching night aids by association in bestowing upon this color the attribute of sedateness. Poets often employ the phrase, "the serene sky," and Southeby uses the word as a noun in the following association:

"The serene of heaven."

Again, the association of blue with the color of the eye, which in turn is associated for various reasons with the intellect, has resulted, perhaps with the aid of the divine attribute, in the signification of this color for intelligence.

Purple, of a hue resulting from mixtures of approximately equal parts of red and blue lights, has long been the color of state. Why it has dyed the robes of royalty perhaps can not be determined with certainty. We know that it was one of the [most costly colors] in early history and this may account for its use as a [regal color denoting superiority]. On the other hand, purple is fairly neutral—between warm and cold—and appears to many to possess a [natural attribute of dignity]. This latter conclusion may perhaps be due to a secondary association, that

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is, its attribute of dignity may easily arise by unconsciously associating this color with royalty. Thus it is seen that the complexity of the associational mental processes is often very great. The exact reason for the regal or stately attribute which this color is thought to possess is of secondary interest as compared with the fact that purple is readily associated with royal garments and draperies. Like other colors it has various significations depending upon other associations.

[White is the logical color for symbolizing purity, innocence, chastity, etc., because of its unsullied appearance.] It is unadulterated, untouched, and uncontaminated.] A ready association of this color with the foregoing and allied attributes is provided by the white mantle of winter.] Is there any person who has gazed upon Nature's white mantle of freshly fallen snow without commenting upon its purity? And have not all of us experienced feelings of guilt or of resentment when this beautiful white cloak is wantonly soiled or disturbed? We associate liveliness with white but not exactly gayety, and hence other attributes are bestowed upon this color which partake of this association.

[Black is the antithesis of white and its association with gloom and darkness renders it a fitting symbol for woe and fear. It provides an environment for evil deeds, and hence is emblematic of crime.) The primal instinct associates darkness with hidden dangers for it concealed the enemy, whether man or wild beast, and these appropriate attributes have clung to black or darkness throughout the entire evolution of the race.]

[Gray is the color of age because the hair of the aged is "hoary gray." This association also results in a signification of ripened judgment and maturity.) It naturally partakes partially of the attributes of its components, black and white, between which it distinctly exists. White is enlivening; black is gloomy; and gray is intermediate, sad.) The winter sky is often "leaden" and we associate this color with depression.

[Thus it is seen by these few simple examples that association is an extremely important factor in the evolution of the language of color.) There are few instances of color expression which do not provide interesting problems for analysis from the associational viewpoint. These problems present many ramifications and

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it is easy to go astray. It has been thought best to avoid the extended discussions necessary to present elaborate analyses of the associational aspects and therefore these brief statements are made with reservation.

1941

NATURE

“The man
Whose eyes ne'er open'd on the light of heaven
Might smile with scorn, while raptured vision tells
Of the gay-colour'd radiance blushing bright
O'er all creation.”

—AKENSIDE.

MANY eyes that have long been “open'd on the light of heaven” seldom notice more than casually the wonderful colors, ever-changing in hue and value, which Nature presents throughout the day and year. The ablest pen can not do justice to Nature's painting because words are not available which describe the endless variation of sequences and contrasts of primaries, secondaries, and tertiaries. This must be left to the painter who possesses materials of descriptive power superior to words for such a task. Variety is indeed the keynote of Nature's composition and she lavishes the contents of an infinite palette with unceasing energy.] No two sunsets are alike and successive moments present everchanging expressions in light, shade, and color which are always full of interest to those who employ their sense of

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vision to its full capacity. It is often wondered why Nature's lighting is so pleasing but the answer is found in its ever-changeableness—its variety.

The thoughtful observer has doubtless often asked with Prior :

"Why does one climate and one soil endue
The blushing poppy with an orange hue,
Yet leave the lily pale, and tinge the violet blue?"

"Ultimately for mankind" is the usual answer and it is reasonable to suppose that such is true when deduced from man's idea of the object of creation. At least there is much of interest in the colors of Nature, much that apparently is tuned in sympathy with human moods, and much that has been the source of our meager language of color.

"To him who in the love of Nature holds
Communion with her visible forms, she speaks
A various language; for her gayer hours
She has a voice of gladness and a smile
And eloquence of beauty, and she glides
Into his darker musings, with a mild
And healing sympathy, that steals away
Their sharpness, ere he is aware. When thoughts
Of the last bitter hour come like a blight
O'er thy spirit, and sad images
Of the stern agony, and shroud, and pall,
And breathless darkness, and the narrow house,

Make thee to shudder, and grow sick at heart,
Go forth under the open sky, and list
To Nature's teachings, while from all around
Earth and her waters, and the depths of air,
Comes a still voice."

—BRYANT.

And in the words of Emerson,

"Nature is a setting that fits equally well with a comic or a mourning piece."

That colors perform many functions in Nature has been suggested or proved by science. The colors of flowers doubtless attract insects that gather food and in return aid in pollenization. It is fairly evident that the colors of many animals perform the positive function of protective concealment. But it appears that a general office of Nature's melodies in fine gradations of hues, tints, and shades, and harmonies of contrast is to please the eye of the beholder and to touch the emotional strings of the finer sensibilities. At any rate, the specific offices of colors in Nature are not of the chief interest here but the fact that Nature has affected throughout the ages, those observing, thoughtful, and sensitive individuals who have directed the mental progress of mankind. It is therefore of considerable moment to inquire briefly into this source which doubtless always has been

a mighty influence upon the intellect of man, especially in the early ages when mythology and superstition were rampant, and will continue to be full of meaning and enjoyment to those possessing responsive sensibilities. In this chapter only glimpses of Nature's part in the development of our rudimentary language of color will be provided; however, in later chapters more specific data will be presented.

In making this inquiry into the possible contribution of Nature to the language of color it appears quite evident that the seasons and the progress of the year, season by season, have been of dominating appeal to the imagination. In a similar manner the relations of light and color to the various portions of the day from dawn to night have not escaped the observation of mankind.

The conspicuous and dominating color of springtime is green. It is at this season that green is fresh, abundant, and unmixed with the coloring of ripening crops or of sun-burnt foliage. It is also dominantly conspicuous at this time perhaps owing to its welcome advent after months of black, white, and subdued color. Spring being the beginning of another year as applied to Flora's yield, its predominant color consistently symbolizes cheerfulness, hope,

freshness, youth, inexperience, and immaturity. This season is sometimes signified by the promising bud and also has been personified as "bright, infantine, and crowned with flowers." White is the usual color of virginity because of its purity and unblemished character, but the poets in the following lines apply the term to spring quite consistently and befittingly associated with this immature season:

"While virgin Spring, by Eden's flood,
Unfolds her tender mantle green."

—BURNS.

"And softly came the fair young queen
O'er mountain, dale and dell;
And where her golden light was seen
An emerald shadow fell."

—LELAND.

Summer is but the continuation and merging of spring or youth into autumn or maturity. It has been personified by a female figure with a lapful of roses and in other ways equally full of meaning.

"When Nature, prodigal of flowers
Holds her own court 'mid rosy bowers;
Where the soft radiant summer's sky
Spreads its ethereal canopy
Deepening while mellowing its hue
In its intensity of blue."

—M. A. BROWN.

This brings to mind one of the most impelling aspects of Nature—the sky. Who can imagine anything more serene than a clear blue sky of a summer's day? Blue, the color of a clear sky, is used to symbolize serenity, tranquillity, constancy, and fidelity. In early mythology the blue firmament held the heavens and was the abode of divine beings. It is therefore consistent that this color be associated with divine love, generosity, and intelligence. The darker shades of this color have been thought to possess the attribute of melancholy, perhaps either through association with the sedateness of the darkened blue sky of approaching night or of the bluish shade of Nature's solitudes. The sky gives character and expression to every landscape and arouses sentiment in the finer sensibilities. It indicates the calm after the storm and in infinite ways "betrays the latent emotions of the spirit of Nature."

The green of spring prevails throughout summer and as the color begins to give way to the yellow, gold, and brown of approaching autumn, the effect is as though the scene were gently touched by the hand of sadness.

"'Tis sweet and sad the latest notes to hear
Of distant music dying on the ear;

'Tis sweet to hear expiring summer's sigh,
Thro' forests tinged with russet, wail and die."

—JOANNA BAILLIE.

Early autumn, with its riot of yellow, gold, brown, red, and purple mixed with some lingering green of summer, is a natural representation of maturity, fruitfulness, and strength. It has been personified as fruitful.

"Rich the bounty Autumn brings."

—H. J. WILLIAMS.

In the following passage the poet has painted the color and mood of autumn in a masterful manner and has given us an excellent example of the expressiveness of word coloring.

"But see the fading many-colour'd woods,
Shade deepening over shade, the country round
Embrown, a crowded umbrage dark and dun
Of every hue."

—THOMSON.

The meditation of maturity has been expressed by some one thus:—

"Go, mark in meditative mood where Autumn
Steals o'er his woods with mellowing touch, like Time
Ripening the tints of some delicious Claude."

The late Autumn is almost universally characterized with a melancholy mood possibly not

inherent in autumn itself but inspired by thoughts of the cold and bleak months near at hand which signify the decay and death of the year.

"The leaves of life are falling one by one

The woods once thick and green are brown and sere;
And youth with all her bounteous hours is done,
And age is here."

—E. N. BLAND.

Some one has beautifully expressed his sentiment of Autumn thus:

"'Tis a scene

That o'er us sheds the mild and musing calm
Of wisdom, breathes as noblest bards have own'd
Poetic inspiration, bids us taste
The lonely sweetness of a walk with her
By Milton wooed, 'divinest melancholy.'
And wouldest thou go, unfeeling, and prefer
The gorgeous blaze of summer to the charm—
The dying charm of Autumn's farewell smile?"

During autumn there seems to be a rivalry of moods, apparently the gayety of summer unwillingly succumbing to the sobriety of autumn. The poet has beautifully suggested this in the following:

"Sorrow and the scarlet leaf,
Sad thoughts and sunny weather;
Ah me! this glory and this grief
Agree not well together!"

—T. W. PARSONS.

This general sentiment is also expressed by Mary Clemmer:

"The Indian Summer, the dead Summer's soul."

Many examples could be presented to illustrate how this autumnal season, the most attractive of all the seasons to poets and painters, is associated in ideas and how the dominant colors become possessed of appropriate attributes.

Winter with her mantle of gray, white, and subdued tertiaries has been variously and befittingly represented, but, in a dominating sense here in respect to the year, as symbolic of old age, decrepitude, and death. Its influence also arises from its cold and bleak aspects and from associating with it the white mantle of ice and snow. Like other seasons it has dominating influences and is capable of reflecting to a certain degree the moods of mankind. Therefore its moods are also sometimes lively but not gay as the summer season.

Winter is often represented as sad and even sullen perhaps through the bleakness of the landscape and the gray skies.)

"See, Winter comes, to rule the year,
Sullen and sad, with all his rising train;
Vapors, and Clouds, and Storms."

—THOMSON.

"Dread Winter spreads his latest glooms."

—*Idem.*

"Every winter,

When the great sun has turned his face away,
The earth goes down into a vale of grief,
And fasts, and weeps, and shrouds herself in sables,
Leaving her wedding-garlands to decay—
Then leaps in spring to his returning kisses."

—CHARLES KINGSLEY.

And to complete the cycle of the year the following is presented in which the poet contrasts winter and spring:

"Gentle Spring!—in sunshine clad,
Well dost thou thy power display!
For Winter maketh the light heart sad
And thou,—thou makest the sad heart gay."

—CHARLES D'ORLEANS.

The influence of natural seasons and portions of the day, and accordingly their corresponding dominant colors, are indicated by many metaphorical relations found in literature. On this point Field has written as follows:

"The analogy of the natural series of colors, with the course of the day and the seasons, coincides with the ages of man or the seasons of life and adapts it to express them in the hues and shades of draperies and effects; from the white or light of the morn or dawn of innocuous infancy, through all the colors, ages, and stages of human life, to the black and dark night of guilt, age, despair and death."

He continues and draws closer analogies between human life, with its attendant moods, and the expressions of Nature. The language of color is apparently universal and though our understanding is meager, there is a consistency which has been an incentive to this study and to this attempt to record it briefly.

It appears to the author that, in reference to flowers, the white and lighter tints predominate in early spring and as summer progresses, yellow and stronger tints appear more in evidence until in late summer red, purple, and blue appear in more abundance, the whole reaching a climax in early autumn in a riot of color. This impression may not be supported by careful investigation, but is presented here for whatever value it may have. This point cannot be passed by without quoting the following appropriate lines whose authorship is unknown:

“Already now the snow-drop does appear,
The first pale blossom of the unripen’d year.
Fair Flora’s breath, by some transforming power,
Hath changed an icicle into a flower;
Its name and hue the scentless plant retains,
And winter lingers in its icy veins.”

In a manner analogous to that of the seasons, the dawn, morning, noon-day, sunset, and night, with their characteristic colors and light effects,

have influenced the emotional nature of mankind. Sufficient examples of these influences are found in succeeding chapters. Throughout Nature all colors are found in varying abundance as apparently coincides with her moods and with her ideas of harmony. Perhaps Nature does not harmonize color at all but, by gradual adaptation, the slowly evolving human organism may adopt its laws of harmony and interpret the powers of colors according to the ruling archeus—the guiding hand of Nature. At any rate, the ultimate result is unaltered and we can join in this sentiment of the poet,

“Who can paint
Like Nature? Can imagination boast
Amid her gay creation, hues like these?
What hand can mix them with that matchless skill,
And lay them on so delicately fine,
And lose them in each other, as appears
In every bud that blows?”

PRIMITIVE LANGUAGE

IT is often remarked that the prevailing color-names found in the languages of primitive races and in the vocabularies of children can be assumed to represent the colors which affect these beings most powerfully. Usually deductions of the orders of preference are made by noting the relative frequencies of occurrence of the various color-names. It should be obvious that such a criterion is dangerous if depended upon too confidently in a study of the expressive powers of colors. The present subject is introduced here chiefly for the purpose of emphasizing the danger of placing too much value upon information from this source. It is reasonable to suppose that the color-names in the vocabularies of primitive beings indicate in a general manner the more powerful colors. However, these are known through other sources including ordinary observation so that such evidence is at best only corroborative. The limitations of interpretations from this source are due, among other reasons, to the incompleteness of knowledge regarding the color-vision of these primitives and the influence of

mental growth in the case of the child. There are many thousands of different colors distinguishable by an adult at the present time; in fact, in a broad sense, wherein grays are considered as colors, the number of different color sensations that can be experienced is perhaps several hundred thousand. It is not surprising that the immature or primitive intellect only comprehends a few of these and it is reasonable to suppose that the most striking colors will be recognized first.

The finer feeling toward colors, that is, the recognition of their beauty, depends largely upon the taste of the beholder and taste, according to civilized standards, is of course largely a matter of civilization.) [The savage or the child prefers brilliant colors while more refined and matured persons prefer to have the colors about them somewhat subdued.] The symphony of greenish, silvery grays of a Corot does not appeal to the primitive mind. Furthermore, it should be noted that preference alone does not reveal the attributes or the ultimate powers of expression possessed by colors. Even refined persons when choosing colors for "color's sake" alone are found to prefer the purer, highly saturated colors to tints and shades yet they do not surround themselves pro-

fusely with these colors. The fact that colors of relatively high purity are in general much more preferred than colors containing components of other hues or of white or "black," has been quite conclusively shown by actual experiments conducted by various investigators as indicated in the third section of this book. Other data of interest at this point are also incorporated in later sections.

Philologists have shown that many of the languages of antiquity are characterized by indefiniteness and paucity of color-names. In many cases red and yellow have appeared earlier than names for green and blue. Some have thought this to be due to a subnormal visual sensitivity to the latter two colors as compared with that of the former, however, the tenability of this hypothesis is doubtful because, according to this view, it must be assumed that the color-sense is of comparatively recent acquisition and that it developed from red and yellow through green to blue. It cannot be argued, *a priori*, that the development of color-names has always kept pace with the development of color sensitivity. Furthermore, it appears incredible that a function so highly developed as color-vision could have evolved in the course of a hundred generations. Finally, it must be noted that

many of the lower animals appear to be able to distinguish practically all colors visible to mankind so it is likely that even the most primitive race of mankind possessed a fairly well-developed color-sense. The explanation of the scarcity of color-names in primitive languages is more likely found in the absence of a need for them. Those colors which are closely associated with the lives of the primitive beings were the first to receive names. Inasmuch as most of the records of color expression of the primitives are not found among the remnants of language but among the relics of handiwork available, it is significant to note that red and yellow pigments were more common than the green and blue during the early periods. In fact it is quite reasonable to suppose that blue pigments were very rare before civilization reached a much higher stage. There is some evidence obtained by experiment that children name the colors red, yellow, green, and blue more often correctly than other common colors and that they apparently prefer these colors more than others.

It appears of interest to review briefly the data concerning the color-vision and the color-language of primitive beings and of children. Gladstone noted the indefiniteness of the color

terminology employed by Homer and concluded that the ideas of color which prevailed during the Homeric age were different from those of the present time. In the early Chinese and Semitic writings, in the Indian Vedic hymns and Norse Eddas, and even in Greek literature, a paucity of color-names is apparent especially those for green and blue. From such studies Geiger concluded that the color-sense for red evolved first, then yellow, next green, and lastly blue. Others arrived at similar conclusions from the same kind of researches. However, such views have been severely criticized because it has been shown that many modern literary works exhibit the same characteristics as the ancient writings.

Philological evidence in this case is open to severe criticism although it doubtless should be given some attention. Examinations of various primitive people by modern scientists have revealed the fact that, while the same word may be applied to black, blue, and other dark colors, the primitive subjects are able to sort these different colors correctly.

The Egyptians employed green and blue pigments long before the Homeric age and beads of these colors have been found even in the prehistoric tombs constructed by this race. Such

facts have been used by some to disprove the existence of color defects in the vision of these early peoples. It has been stated that blue has been used incongruously in Egyptian statues and even in the Acropolis since the time of Homer, but such incongruities cannot be a certain indication of an inability to distinguish colors.

Rivers extensively studied the color-vision of primitive tribes and showed that the languages of these uncivilized and primitive peoples indicated different stages of evolution of color-names which closely correspond with the progress of evolution of color terminology, as concluded by Geiger and others from studies of early writings. For instance, certain Australian natives used one color-name for red, orange, and purple; another for black, blue, and violet; and a third for white, yellow, and green. Other tribes used a definite term for red; a less definite name for yellow; one name for green, black, and white; and another name for black, blue, and violet. Some primitives gave the same name to green, violet, and black.

Other natives appeared to have advanced into further stages of development of color language there being four fairly distinct stages detected by Rivers which corresponded with the general

intellectual development and degree of civilization. Those of the lowest stage had names for red, white, and black. In the next stage there appeared an additional name for yellow and an indication of one for green. Those primitives in the third stage had a definite term for green and a less definite one for blue. In the highest stage there were names for green and blue although some confusion appeared to exist. In the primitive languages that have been examined, which included those of primitive tribes of Australia, Africa, Asia, and South America, the absence of a definite word for blue is quite common and often the same term is used for green and blue. The extensive investigations performed by scientists in various parts of the world tend to corroborate the general conclusions already presented. Much of this work was done with the study of color-vision as the chief object. However, from the viewpoint of this book the relation of color-names to the degree of intellectual and cultural development is of greater interest.

Environment doubtless has been a great influence upon the sensibility of the human organism to various colors and consequently upon the introduction of color-names into languages. Our attention is drawn to rare occurrences more

decidedly than to those that are common. Red is relatively rare in nature and therefore when it occurs, as in such a case as a red flower amid sylvan surroundings, the attention is attracted. The red object is mentally noted and remembered while the green surroundings make little or no impression excepting upon those who are exceptionally observing and analytical. Thus it is possible that the primitives of the lower types would naturally have a name for red but none for green and blue which occur in vastly abundant areas in Nature. Red objects, besides being relatively rare in Nature, have another claim to the attention of the primitives because they often represent objects of importance in the daily life of these beings. For instance, such things as animals, iron, stone, fruits, and meats are not uncommonly red in color. The green foliage which is so abundant and extensive in area in most summer and tropical landscapes abounds in a variety of shades and hues. This demands some degree of discriminating ability so that it is not surprising to find at least a slight degree of development of perception for green colors among the primitives. However, the extensive areas of the blue such as the sky and the sea are not striking because they are so commonplace and unsaturated in color.

Furthermore, blue is not commonly associated with objects of necessity or of practical importance to the primitive being.

It can be concluded from the foregoing that color nomenclature usually begins with red and progresses in general toward the blue end of the spectrum. In the early stages of its evolution the transitional colors such as orange, blue-green, and violet are passed by. Nearly all languages have a name for red; most of them have one for yellow; but comparatively few have a conventional word for green and fewer have one for blue. It is not uncommon in primitive languages to find the same name applied to colors closely related in the spectrum.

Some of the American Indian languages have no color-names, the color of an object usually being described as being like that of another more common object. In the absence of fixed comparison standards it is seen that color language is in a very primitive state, subject to change at any time.

Woodworth suggests the possibility of several stages in the establishment of a color-name. In the first stage there are no conventional names for colors but comparisons of color are made in terms of the colors of common objects. In the next stage the usage centers about some

comparison standard so that all objects having approximately the same color are said to possess the color of a particular object. Abstract names begin to appear in a later stage and no longer are the particular comparison objects thought of when their names are used in designating colors. An example of the last two stages is the word "orange" in our vocabulary of color. In still later stages the color-names evolved in this manner may become obsolete as applied to the object and remain exclusively as the name of the color. Some of these latter cases are very interesting from the viewpoint of the evolution of color meaning.

Doubtless the usage of a color-name becomes fixed if the name is employed sufficiently; that is, if the need for it is quite urgent. It does not appear essential that an absence of a definitely established usage indicates an absence of high sensitivity to colors because the common color-names of the most elaborate languages cover many actually different colors. For this reason the first primitive color terminology persists in the vocabularies of those who do not find it necessary to describe colors with accuracy. Many of the difficulties encountered in primitive languages, in describing colors, persist in modern languages of highly civilized people.

ples. For example, most persons confuse and misname the colors between blue and green.

The modern languages of the highly civilized peoples are rich in names for various parts of the spectrum. Our language is far richer in abstract names for the colors of the red end of the spectrum, that is, from yellow to red, than for colors in the blue region. Woodworth presents various names in which the color reference is thoroughly dissociated, in common usage, from any specific object. For reds and yellows and their various tints and shades he presents: red, rubicund, russet, roan, auburn, carmine, crimson, scarlet, brown, bay, sorrel, dun, yellow, tawny, sallow, lurid. To these he suggests the possibility of adding buff, maroon, vermillion, and perhaps such words as magenta, since the objects to which these names primarily refer are unknown to most persons. For the greens, blues, and violets he presents the following: green, verdant, blue, azure, purple, ivid. It is thus noted that names for red and yellow not only develop first in an evolving language but names for these colors predominate even in highly developed modern languages.

It has already been shown that names for red and yellow are in greater demand in primitive language because these are colors associated

very predominantly with things of great importance in the lives of primitive beings. These colors are associated with animals and it is said that certain African tribes name them without difficulty but they cannot name colors such as blue and green although they can distinguish them. As Woodworth states: "The absence of a name for a sensory quality does not point to the absence of the quality. The case of smell is convincing. Odors are vivid experiences yet there is almost complete absence of abstract odor names from all languages."

Many objections have been offered against the use of such data as the occurrence of color-names in primitive languages in drawing conclusions as to color blindness or other facts of color vision. These objections are well founded. It is likely that a color-name is introduced into a language only when it is necessary, and necessity is not essentially related to color-sensibility. However, from the viewpoint of the impressiveness of colors upon the human intellect, the occurrence of color-names in language is of great importance because it appears fairly certain that colors having the ability to impress the intellect powerfully will naturally be provided with names. For this reason the foregoing discussion has been presented.

In closing this brief chapter it is of interest to discuss the impression of colors upon the primitive intellect of the child because many accept the analogy between the development of the faculties of the child and the evolution of the race at large. Darwin drew attention to the fact that the child does not possess the ability of distinguishing colors until after it is able to discriminate most common objects correctly. The results of some elaborate investigations indicate that the normal child is unable to distinguish colors accurately until nearly two years of age. It is apparent that the child is able to distinguish colors before it is able to name them. Others have claimed that the child begins to appreciate colors as early as in the fifth month. Experiments of this kind are difficult to interpret and various methods that have been used appear to yield different results. Color-sensation, association, brightness and novelty play important but more or less undetermined rôles. Without entering into an elaborate analysis of the data available no more definite statement can be made than that the child is impressed more with the striking colors and that brightness and novelty are important factors. Although the data obtained by different methods with young children of various ages, from three

months to two years, do not agree, it appears safe to conclude that among the various colors red is the more striking to the child than blue and is named correctly at an earlier age.

LITERATURE

"Poets are Painters;
Words are their paint by which their thoughts are shown,
And Nature is their object."

—GRANVILLE.

THE poetry of coloring is a common phrase but the coloring of poetry apparently has not been so generally appreciated. Metaphorically, the poets are word painters and literally, reference to their use of color, they are actual painters of figures, natural and rhetorical. Utarach says, "It is a common saying that poetry is vocal painting, and painting, silent poetry." Poetry abounds in the use of color and its descriptive power and emotional effect among the poets are found not only masterly word painters but skilled colorists in the selection and arrangement of colors. In the works of Homer, Milton, Spenser, Byron, and others many examples of delightful coloring are found, but Shakespeare's ability is not excelled in conceiving the beauty and power of color and accurate knowledge of its science and of its harmony he stands eminently among the best writers. In the use of color, poets appear to

exhibit individuality just as the great masters of painting, but there exists among them generally consistent symbolism of color.

It is delightful and profitable to study the use of colors by the poets from the viewpoint of scientific knowledge and technique. Some mention of these aspects will be made occasionally in passing but the chief interest will be focussed upon the symbolical use of color. Doubtless the literary writers of the past are largely responsible for the rudiments of the language of color which are available to-day and it is encouraging to note a consistency among them in recognizing the attributes possessed by various colors. The vagueness of the nomenclature of color engenders difficulty in describing colors, and for this reason the uses of color by the poets must be carefully analyzed. Furthermore, it must be remembered that color in poetry is merely an element in the ensemble which has been organized for the purpose of realizing various mental pictures, sentiments and moods. Therefore, a color in one ensemble may possess a signification quite different from that amid another environment. For this reason concrete examples in the form of quotations from the poets are presented in this brief work.

Artists and others interested in color can profitably borrow from the poets who have taken advantage of the powers of colors on the imagination in much of the imagery and witchery of their art. A great deal of the charm of many poems, or portions of them at least, is due to the bewitching power of colors. However, it appears unlikely that spoken or written coloring has possibilities in appealing to the imagination and emotion as great ultimately as painted coloring, assuming the same degree of development in the imaginative power to which both make their appeal. Spoken coloring is limited in expressiveness to the significance of words whereas painters, perhaps, will ever be able to apply colors beyond the descriptive power of language. In other words, the eye is the primary apparatus especially designed and adapted for the perception of color. It is the normal gateway for the stimulus on its way to arouse a color sensation and, finally, an emotion. Notwithstanding the foregoing, the poet has employed colors delightfully, thoughtfully, and with good effect.

Among the poets are good and bad colorists. Some apparently are concerned only with euphony while others interweave science, harmony, and beauty of color with wonderful ef-

fect. Some one has declared the poet, Ariosto to be a Titian in the art of coloring poetry; however, from both viewpoints of quantity and quality of coloring, Shakespeare must be ranked among the foremost. Among the poets of lesser fame, there are many who have exhibited noteworthy ability in the use of color but they must be largely overlooked in a fleeting discussion of this character. The poet has the advantage of poetic license which frees him from the necessity of using color as it is found in Nature and thus is enabled to extend his descriptive powers. He is licensed to describe the sea as the "black ocean," the "emerald main" or the "azure deep" and may freely extend this license to all natural and imaginary things.

The colors used by the poets represent the whole range of the spectrum and also of the purples. These colors are often more or less disguised by merely inferring one or more of them and thus awakening the imagination; by using more euphonious terms instead of the simple color-names; and by substituting natural objects which possess characteristic and well-known colors. For instance, gold often takes the place of yellow or orange and furnishes metallic luster or glitter in addition to the hu-

The poet runs the whole gamut of primaries, secondaries, and tertiaries, and it might be said that he avails himself of all the gradations of hue, tint, and shade, that his imaginary palette contains. His supply of colors is only limited by his ability to observe, to imagine, and to describe.

Poets appear to exhibit distinct preferences for certain colors; for instance it is not surprising to find Milton's palette often set with black and red. Sometimes the primary colors are boldly contrasted and harmonized or the secondaries may be employed. They exhibit various moods, sometimes preferring the quiet, restful or somber palettes consisting of shades but as often having gayer moods when they delight in painting boisterously with bright colors or delicately with light and airy tints. Their uses of color are not always simple, clear or bold. Ofttimes the color is so subdued or hidden that only the subtle influence of its "atmosphere" is felt. However, an analysis of their individual palettes is beyond the scope and aim of this brief discussion. As already stated, the present object is to illustrate as broadly and concisely as possible the symbolical uses of color by the poets by means of excerpts from their works. These examples, which are pre-

sented in other chapters, have not been selected primarily for their beauty of coloring but for the purpose of illustrating various different applications or associations of each color which appear of value.

In selecting the examples of symbolic color in poetry it is difficult to escape from the charm of many fine sketches of coloring encountered. Appreciation of color makes our surroundings more beautiful, adds beauty and interest to art, and widens the appeal of poetry. Hence, it appears worth while to digress for a moment to view other aspects of color in poetry aside from the primary aim of this book. The following beautiful color sketch by M. A. Brown illustrates the value of color in enhancing the witchery of poetry:

“ ’Twas in a glorious eastern isle,—
Where the acacias lightly move
Their snowy wreaths, where sunbeams smile
Brightly, but scorchingly, like love,—
Round which the ocean lies so clear
The deep red coral blushes through
The waves that catch its crimson hue,
While the soft roseate tints appear
Mix’d with the sky’s reflected blue!
Where, brilliant as the golden rays
That shine when day gives place to night,
The shells, that are as rainbow bright,
Glow through the waters in a blaze

Of glorious gold and purple light!
Where roses blossom through the year,
And palms their green-plumed branches rear."

Imagine the foregoing passage stripped of its coloring yet doubtless many are practically color-blind in respect to poetry as they are to many other beautiful uses of color about them. Some of the poets appear to have had a considerable knowledge of various sciences and in the science of color some have exhibited an acquaintance with the phenomena of simultaneous and successive contrast, of after-images and with the laws of color-mixture and harmony. Shakespeare's knowledge of these aspects of color is illustrated by the following passages. He often takes advantage of the law of simultaneous contrast, the effect of one color upon another adjacent to it. This is simply but effectively demonstrated by means of two examples of white contrasted with black.

"Whiter than new snow on a raven's back."

"I take thy hand;—this hand
As soft as dove's down, and as white as it;
Or Ethiopian's tooth, or fann'd snow that's bolted
By the northern blast twice o'er."

His acquaintance with the visual phenomenon of the after-image is illustrated thus:

"My mistaking eyes,
That have been bedazzled with the sun,
That everything I look on seemeth green."

Other examples could be presented to illustrate that poets are skilled in the science and technique of color, however, with the risk of digressing far from the symbolical aspect.

In the nineteenth century there arose in France a group of poets who aimed to express poetic sentiments by the use of forced or strained metaphors and by means of the sounds of letters and words. They assumed an existing harmony between vowel sounds and musical instruments and according to one writer "dwelt much on the hidden influence which should exhale through the inclosing envelope of the spoken word." They believed in a suggestiveness of the sounds of letters and words quite independent of their ordinary signification and attempted to apply these ideas. For instance, according to some the sound of the vowel *o* suggested red and according to others it suggested blue. This difference of opinion is not surprising when the complexity of the psychological phenomena and the scarcity of knowledge regarding them are considered. Prominent in this school of Symbolists, as they were called,

were Verlaine, a "lyric poet of high order," de Regnier, and Aréthuse.

The symbolic use of color in literature is not confined to poetry although the poets have contributed more definitely to the language of color than other writers. Occasional imaginings of writers of both classic and popular literature are found which indicate that others besides those intimately associating with color as a science or as an art have been impressed with the possibility of extending the employment of color for emotional effect. It is true that some of these are merely the wildest flights of fancy with no firm basis of fact beneath them but there are other examples worthy of attention. Sometimes these imaginings have involved the use of color so positively, logically, and unassisted as to appear that the writer was fostering the belief that a language of color might actually exist outside of fiction. Confusion has arisen in the minds of readers when an author grasps some abnormal psychological condition such as chromæsthesia and weaves a story apparently based on fact. However, such cases as colored audition and colored gustation are rare and abnormal, although it might be contended that they are mutations which are fore-

runners of a new type. However, those who seize upon such abnormal and isolated cases to play upon the imagination are not usually sufficiently interested in the facts to supply an excuse or argument such as the foregoing.

Further discussion of this rare phenomenon would not be justified here if it were not for the harmful influence it has had in certain discussions of what has been termed "color music." A number of cases of chromæsthesia have been studied by various investigators and there appears to be scanty consistency among them. For instance, a certain taste or sound, depending upon whether the case is one of colored gustation or of colored hearing, does not have associated with it similar color sensations in the different cases on record. One subject may regard his chromæsthesia as the result of some sympathy existing in him between auditory and visual experiences whereas another may recognize the "colors" of certain tastes by their "feel." In one of the latter cases, substances as different as cayenne pepper and quinine were indistinguishable as tastes both producing the same "feel" and inducing the same color, a dull orange-red. The behavior of the induced color in this case was dependent upon the tem-

perature of the solutions. It apparently has been proved in some cases that chromæsthesia was sensational rather than imaginal. In a case of colored audition the colors were induced by tones,—timbre, intensity, and pitch being conjointly influential. Tones below 600 vibrations per second induced orange and brown colors; those above 12000, a colorless gray; and those between 600 and 12000 vibrations per second gave blue changing to green. In one case the subject experienced colors for spoken or written words and sounds, the endless variety of color and shading being the special feature of the case. The colors were always seen “hovering in space.”

In a table representing the reports of twenty-three cases of colored hearing, the most apparent characteristic was the wide range of individual variation. These cases are briefly noted merely as of interest in passing and in order that no misinterpretation may result from their mention here it is again emphasized that these abnormal cases cannot at present be considered as of any importance whatsoever in the possible future art purely of color. Besides a mere passing interest they have been briefly considered for a negative purpose; that is, for

the purpose of warning against any imaginative uses of this and similar phenomena which may be employed by writers.

Prose has contributed toward the standardization and extension of the language of color in quite the same manner as poetry but perhaps not as effectively. For this reason the examples of symbolical uses of color which are presented from poetical writings will not be repeated by means of prose examples. It is doubtful if writers of prose have aided in other ways unless by their imaginings they have stimulated or directed thought in certain directions. It is with considerable hesitancy that the author continues this subject further at present because of a fear that the discussion may be more harmful than beneficial to the cause. However, it appears safe to mention a classic instance of a beautiful employment of imagination in "The Blind Musician" by Korolenko. In this sketch which the author calls a psychological study, he has attempted to study and analyze the inner life of the blind. The subjects of this study are a blind girl, whom the author had known as a child, a boy pupil of his who was gradually losing his sight, and a professional musician blind from birth but scholarly, refined, and intellectually gifted. The life

of the blind musician is followed from birth to manhood and his education in colors, by representing them as sounds, is interestingly portrayed. Doubtless it is largely fiction; but classic fiction properly digested has value even in the discussion of a subject such as the present one where the object is to build with facts.

PAINTING

"Every passion and affection of the mind has its appropriate tint; and colouring, if properly adapted, lends its aid, with powerful effect, in the just discrimination and forcible expression of them; it heightens joy, warms love, inflames anger, deepens sadness, and adds coldness to the cheek of death itself."—OPIE.

IT might logically be expected that the art of painting should contribute very materially to an understanding of the language of color, but the definite data available from this source aid us but little more than by verifying that obtained from other sources. However, there is reason to believe that the art of painting will likely contribute much of value in the direction of interest here. This art is apparently in the midst of one of its periodic upheavals during which it seems that a state of anarchy exists. During such disturbances in art, as well as in other fields, many experiments are conceived and performed and those interested in progress welcome them and await the results expectantly. Of course, experiments are always in progress in art as in other activities but it appears that the present is seething with new and anarchistic

ideas in the art of painting to an extent only equaled at rare periods many years apart. Much criticism and relatively little commendation is heard on every side but it appears that, if sympathy is so meager that encouragement cannot be extended, at least an open-minded indulgence should prevail.

A comprehensive study of the signification of color in painting is a tremendous undertaking if it is to be exhaustive. In this primer of the language of color, wherein the object has been to remain close to proved facts and accepted symbolisms of color, it would be beyond the scope and aim to record the results of such a study even though it were made. It has been considered the wiser plan to carry the discussion in many cases only so far as definite data, universal in application, are yielded because beyond this the interpretations become limited in value. Furthermore, at the present time the author acknowledges inability to analyze this subject beyond the realm of accepted facts. Doubtless there are artists who apply the language of color too deeply for even the thoughtful observer to analyze but it has been difficult for the author to obtain positive data from the writings of the great artists.

The evolution of the use of color in painting

is in itself a delightfully interesting study. Not long ago paintings were almost universally realistic or photographic in character, the subject, usually very simple, being the chief means of appeal employed by the artist. Pure and undiluted pigments were applied sparingly if at all. They were usually toned down apparently through lack of confidence or through fear of consequences. Backgrounds were begun falteringly in dark secondary and tertiary colors and the finished painting, as compared with many of the colorful works of the present period, appeared to lack stamina and power. It is true that certain schools, generations ago, employed much beautiful coloring, yet the realistic subject was depended upon to make their work interpretable and acceptable and to over-ride criticism. Slowly the artist gained confidence in the employment of purer colors and apparently through this growing use he has gradually gained in his comprehension of the powers of colors.

In the past, the art of painting has contributed to the language of color by using colors symbolically in accordance with the established usage in mythology and ecclesiasticism. In this manner the signification of colors has been strengthened by association and common con-

ent quite independent of the necessity of justifying these usages from any deeper or more fundamental influence; that is, it matters not if the established symbolism is supported by real corresponding effects of the colors upon the mind. The deeper and more fundamental source of data for the language of color lies in the unexplored unknown which the psychologist is best equipped to invade but, as stated before, we can not reject the language which is already established by common consent throughout the past ages. Hence in chapters which follow the pure symbolic uses of color in painting will be utilized in building our rudimentary dictionary.

The artist has employed colors according to a more or less vague understanding of their psychological influence. The drapery of color is cast over paintings certain moods, often obviously consistent with our scanty knowledge of such powers of colors. Many artists have realized that color can excite the imagination and extend ideas and those who have comprehended this have been able to awaken in the thoughtful observer a responsive chord, as yet, perhaps, generally defying complete analysis. To revert to the discussion of the possible contributions of color in painting it appears that,

with the development of the art of photography, the artist foresaw defeat in the production of realistic records and therefore turned with more earnestness to the problem of revealing the hidden powers of colors. Photography can produce in black and white a satisfactory imitation of the appearance of natural objects and even with a fair degree of success can reproduce the colors. In the presence of knowledge these records satisfy the requirements of "subject" appeal. But the artist was undismayed who realized that colors guided by skill, perception, and imagination still contained the inherent power of producing a fairer or deeper creation than Nature herself. This stimulated the realization that the object of painting was not mere copying, in that painting not only embodies a reproduction of Nature but an expression of the thoughts, impressions, and emotions of the artist. Such a combination as colors, technique, knowledge, perceptive power and imagination need not fear photography.

Realism began to give way to expressions of light—the broad term which includes all color. For instance, Turner's later works, radical and "futuristic" during his time but accepted to-day as wonderful expressions of color, are examples of the result of breaking away from

the traditional painstaking reproduction of a realistic subject. The story of the evolution of the employment of color expression in painting is replete with such awakenings on the part of artists and also ultimate, though lagging, changes of attitude on the part of critics. Notwithstanding these examples in the past history of art, the antagonism toward modern *isms* in art to-day is as intense as it has been toward correspondingly radical departures during the past. The same condition is exemplified throughout the entire past by the persecutions of pathfinders in science, invention, politics, biology, and other fields of endeavor but these wrongs are blithely ignored or forgotten when the martyrs are gone and their dreams have come true. It is certain that impostors are numerous, but mankind should have learned long ago that the grain cannot be harvested and separated from the chaff unless seeds are first planted, encouraged, and nourished to maturity. Furthermore, many successes have been built on radical departures in the use of color in painting.

The unprejudiced must find it difficult to avoid admission that the modern *isms* in painting have already borne fruit if they have accomplished no more than to stimulate experimental-

tion and thought and to stiffen the backbone of the artist which has resulted in a bolder use of color. These new movements may give rise to an ultimate use of color largely for "color's sake" and, by suppressing the prominence of realism or subject, may possibly contribute more definitely to the understanding of the language of color than all the painting of the past. In the furore of criticism and defense, of which the modernists in painting have been the center during the past few years, many viewpoints have been aired. The aim of these "anarchists" has been variously stated many times; however, another view, which possibly may not be original, appears to be sane at least. Judging the work of the extremists to-day the traditions of the past must be kept in the background. It is ill-spent and unfair criticism that results from a judgment of a new movement entirely in terms of the standards of the past. The standards of realism are nearly as useless in measuring the value of futuristic art as a tonoscope would be in determining the odor of a rose. Judged by the old standards, the sky could not be painted scarlet or yellow-green for the artist must not be a nature-faker only to a reasonable degree. However, is it not possible that the modernists are demanding an extension

of "coloristic license"? And are they not entitled to an extension of this license to a degree comparable with the extent of poetic license enjoyed by the poet? The author does not attempt to answer but is resigned to await the results of the experiments now in progress.

To recapitulate, let us ask, What is art? The answers that have been given to this question are extremely variable in construction or in superficial meaning, but many of the ideas presented are quite similar. The general sentiment is that art is the perfection of Nature or indeed, as Emerson has said, the aim of art is to produce a fairer creation than exists in Nature. It appears that possibly both are correct and surely they are ultimately identical. In painting it must be understood that not only the physical is depicted but all appealing art of this character includes painting of the mental. Various schools appear to attempt to paint different proportions of these two elements. In order to improve upon Nature the artist must depend upon improving the mental aspect because he cannot in general reproduce from pigments alone the physical in a scene. As Mason has beautifully expressed it:

"Vain is the hope by colouring to display
The bright effulgence of the noontide ray

Or paint the full-orb'd ruler of the skies
With pencils dipt in full terrestrial dyes."

Logically it might be asked, how can the artist perfect or improve upon Nature if he is limited at the outset by the incapacities of pigments in rendering the physical? It is possible that he may accomplish this perfection by bringing together in one grand ensemble all the elements, physical and mental, which coöperate to the same end without waste or discord. Nature is wonderful to look upon, is always interesting, but only occasionally presents the ideal. Ruskin has expressed a similar sentiment thus:

"Painting with all its technicalities, difficulties, and peculiar ends, is nothing but a noble and expressive language, invaluable as the vehicle of thought but by itself nothing."

Plotinus and many others who have philosophized on art and the beautiful contend that beauty does not exist in the material substance but in the ideas which natural forms very inadequately reflect. It is not seen with "the outward, but with the inward eye." The German artist, Mengs, defined beauty as "visible perfection, an imperfect image of the supreme perfection." According to Goethe, "Beauty is neither light nor darkness, it is twilight, the

medium between truth and untruth." Hogarth contends that the charm of painting which is due to colors depends upon their infinite variety and states that coloring in the art of painting has been "a mystery of all ages." Plato found the beauty of color to lie in its intrinsic significance and symbolism but also attributed to color a pure sensuous agreeableness.

The definitions of art and beauty and the rôles apportioned to color are almost numberless and also quite diverse, however, there is a general agreement that beauty depends upon harmony—a harmony of both the physical and mental aspects. Many of those who contend that beauty is the result of harmony also accord with the sentiment that it emanates from the soul. Certainly that which we derive from viewing a masterpiece of art is in direct proportion to that which we put into it. The answer to the question concerning the part which color plays in the harmony which is essential to beauty will only be completely answered when the language of color is written. No color is beautiful everywhere, but each color is beautiful in its way and in certain environments and relations. This brief discussion of art and beauty is presented with the hope it will aid the reader who gives further thought to the expres-

siveness of color in painting. This subject is touched upon here and there throughout this book.

Although painting has contributed in many ways to the language of color its most positive or most apparent contribution has been through the symbolical use of color. St. Augustine has said of the representations of art that they are "libri idiotarium" (the books of the simple) and certainly one of the chief aims of early art was to teach. Hence there arose a definite symbolism which is quite uniform in respect to line and form but less easily analyzed in respect to the use of color. As art advanced, symbolism has been influenced by tradition, convention, esthetic taste, and intellect, however, from its early infancy various forms and symbols have been a part of its language. These are meaningless without understanding but when noted and analyzed they form an interesting part of the expression of the representative arts. Colors are used symbolically to express a simple fact or sentiment, to emphasize a mood, and directly or indirectly they are effective through various associations. Thus it is seen that the field of painting is a fertile one but it will not yield the facts of the language of color without careful and thoughtful cultivation.

ECCLESIASTICISM

RELIGION, ecclesiasticism, and liturgy have contributed something to the signification of colors and have strengthened their symbolical usage. Especially in the early ages, emblems formed an important part of religious ceremonies and in some churches these have survived to the present time. Many sources were drawn upon for emblems in the church and the conspicuousness of colors did not escape the early ecclesiasts. It appears that the same general significations were attributed to colors among many of the nations of remote antiquity. Colors provided an easy means for transmitting thought and for aiding the memory. To some extent, certain colors were arbitrarily associated with religious events and ideas.)

The colors used in religious ceremonies were adapted from early writings and some usages originated in the mandates of powerful ecclesiasts. The significations of colors are found to be in accordance with usages established in other activities as well as with the arbitrary mandates and the resulting customs.) Many adopted meanings were merely fitted into the real and

mythological episodes which formed the basis of religion and therefore many significations of colors arose and became established within the church. Paintings executed expressly for church decoration and for illustrating the teachings were doubtless guided in coloring, as in other details, by the ecclesiasts and hence the uses of colors in such representations as well as in the religious ceremonies cannot be disregarded in the present review.

According to Fairholt, the history of symbolic colors in Christianity indicates a triple origin marked by the three epochs in the history of religion, namely, the divine, the consecrated, and the profane. The first regulated the costume of Aaron and of the Levites, the ritual of worship, and similar matters. Sculpture and painting were introduced for illustrating the teachings and for decorating the temples and thus the consecrated language arose. The theocratic era extended until the Renaissance at which time the symbolic expression largely disappeared, that is, the "divine" language of color was smothered in the evolution of painting from a science into an art. This marked the beginning of the "profane" era in which the symbolism of colors was largely banished from the church and the "divine" and the "consecrated"

language of colors gave way to the “profane” language.

In the latter part of the Middle Ages the symbolic use of colors in the church became disorganized. Other colors and various combinations were introduced and these innovations crept into the Sarum ritual. The five “mystic” colors, which were supposed to have been given by God to Moses, were in general use in England until the middle of the sixteenth century. The lack of uniformity in the symbolic use of colors at the present time is doubtless due to the fact that modern churchmen exercise their fancy and taste which in olden times were made subservient to the “divine command.”

Inasmuch as the Sarum use is conspicuous in the symbolism of colors in the church, it may be of interest to note the origin of the term. Sarum was a small borough in England which dated from the time of the Romans although it is now extinct except for a few ruins which mark its site. At the time of William the Conqueror, the Church of England was split into two parties, the conquerors and the conquered, according to Rolfe. In order to preserve a uniformity of divine service between these rivals the bishop, whose seat was at Sarum, revived and standardized the signification of the five

“mystic colors,” red, gold, blue, purple, and white, hence the origin of the Sarum liturgy. An interesting reference to these colors is found in the Bible in the first part of the twenty-eighth chapter of Exodus. A discussion of the significance of these colors would occupy too much space to be presented here because their uses are complex. An excellent discussion is presented by E. C. Neff in a book on Christian symbolism. As already stated, the colors of vestments and of the draperies of the altar, sanctuary and pulpit were often significant. In the Greek church only two colors were used, red being favored for Lent; and in the Armenian church no colors are apparently given special significance. The five colors, white, red, green, violet, and black, constitute the “Roman sequence” in the Roman church. The Anglican church has perpetuated the divine command to Moses in the Sarum liturgy although this use is not universal among its adherents.

No attempt will be made to give an exhaustive discussion of the ecclesiastical uses of color but a few examples will be of interest. Fairholt gives the following symbolic significances of various colors in ecclesiasticism:

Red: charity, martyrdom for faith.

Gold: glory, power.

Saffron: the confessors.

Green: faith, immortality, contemplation.

Pale green: baptism.

Blue: hope, love of divine works, sincerity, piety.

Pale blue: peace, serene conscience, Christian prudence, love of good works.

Violet: penitence in connection with figures of saints.

Purple: dignity of justice, royalty.

Rose: martyrdom.

White: chastity, innocence, purity.

Gray: tribulation.

In the Roman church it is found that white, as the symbol of purity, has been used on the festivals of angels, Virgin Mary, Christ, and also of saints, and at matrimonial ceremonies. Red, as the color of blood, has prevailed on the festivals of martyred saints, and of the Holy Cross. Violet or purple has been the color of penitence in Advent, Lent, etc. Green, the color of hopeful springtime, has been used during such intervals as from Trinity to Advent Sunday. Black is consistently used on Good Friday, at funerals and during memorial services. These usages have persisted, more or less, for centuries.

In the Middle Ages, white was the general Lenten color, not from any direct significance of

its universally recognized attribute of purity but from that of screening all colors from view by the use of white coverings and draperies. Blue has been used in the past by priests at the grave, in which case it is emblematic of heaven. White is used very generally at Feasts and at seasons pertaining to the Lord that are not associated with suffering. White is used for mourning and red for the marriage service by the Chinese.

In China and in some other parts of the Orient, yellow has been a sacred color. It appears to be believed by some that, with the advent of Christianity, yellow and, to some extent red and orange were looked upon with disfavor and the use of the colder colors nearer the blue end of the spectrum was encouraged. Doubtless it was thought that these latter colors were symbolic of dignity, purity, and submissiveness. Yellow became the mark of jealousy and shame and other warm colors, notably red, shared occasionally in this unenviable distinction. These prejudices became so firmly implanted that even at the present time their effects are often distinguishable. Such influences are not insignificant in their effect upon our present attitude toward colors.

Gold and silver, which besides their color pos-

ess brilliancy and luster, play important parts in ecclesiasticism. The cross, glory, aureole, and nimbus are often covered with gold or silver which can readily be interpreted as representing brilliancy, light and sanctity. Sometimes these symbols have appeared in various colors and it is believed by some that these colors had certain meanings.

The rose and the lily are conspicuous in religion; both having been dedicated to the Virgin Mary. In this office the former is emblematic of love, and the latter of purity.

In a few instances, early in history, green has been held a sacred color. The use of blue occurs often in the traditions and paintings of Christianity. In these cases it is usually emblematic of fidelity and of divine intelligence. White is generally used as an emblem of chastity and of allied virtues. Black naturally assumes characteristics opposite to white and therefore symbolizes woe, horror and wickedness. Gray is an office between black and white, and is therefore associated with penance, sadness, and humility. It is interesting to note the emblematic uses of combinations of these colors many of which are extremely logical.

The Trinity has been represented by red, signifying divine love; blue, emblematic of truth

and constancy; and gold or yellow denoting divine glory. It is interesting to note that yellow, when representing gold, possesses desirable attributes being variously used to signify love, constancy, wisdom, dignity, light, and glory, especially in connection with the great characters in religions.) Otherwise yellow is attributed with uncomplimentary characteristic. For example, in France in the tenth century the doors of the abodes of felons, traitors and other criminals were painted yellow and Judas was often represented with a yellow robe in oil glass paintings signifying inconstancy, jealousy and deceit.

Black, which suggests darkness and gloom resulting from the absence of light, is a symbol of spiritual darkness. It has been associated with witchcraft or diabolical power from which significance has arisen the name for the mysterious "black art." Most of the illusions to black are uncomplimentary or disgusting.

In certain churches it is said that the old English or Sarum colors are being revived. According to one writer, these colors are used as follows in the draperies and vestments: red is the ordinary Sunday color, as a penitential color on Ash Wednesday, Good Friday, Easter Eve and Whitsun Even, and also on the same days

sed in the Roman church; white throughout Eastertide; yellow for confessional feasts; and brown or gray with violet, for penitential seasons. As already stated the uses of these colors are too extensive and complex to be more than touched upon here.

In various monastic orders colors are significant, though naturally the somber colors such as black, brown, gray, and combinations of black and white predominate. The lily is dedicated to the Virgin Mary with consistency and fine sentiment. It also officially belongs to a number of saints. Angels, which in early art were always naked, have been clothed, almost universally, in white, filmy fabric in mythological representations. Violet or amethyst, signifying passion and suffering, usually in relation to love and death, is worn by Magdalene and by the Magdalen after the crucifixion. Sometimes Christ has been represented in a violet mantle after the resurrection. As already shown, yellow or gold, emblematic of the sun, of glory, of fruitfulness, etc., plays a prominent part in the symbolism of religion and its ceremonies. Yellow or a dingy hue often signifies inconstancy and deceit. These examples are sufficient to indicate that an exhaustive study of the significance of colors in ecclesiasticism, in representations

of events which form the foundation of religion and in its attendant ceremonies, should yield much interesting data. Only a glimpse has been given into the subject but further detail can be obtained from treatises on symbolism in religion.

THEATRE

IN the drama, colors have been endowed sometimes with emblematic characteristic or have been assumed to possess attributes which suggest certain events and sentiments or which are of definite emotional value. The theatre has always provided a place for addressing the masses through the language of color but development in this direction has been barely perceptible. The reason is two-fold, first, only the faintest rudimentary language exists, and second, the colorist with a broad knowledge of the various aspects of color is not only a rarity but he has not yet found his way into the theatre. It may be that the experimenters in the modern theatre are rising to this opportunity. At any rate there is evidence of attempts being made to tap his source of possibilities.

The rhapsodists of Greece, when reciting in a theatrical manner, employed colors appropriate to their subject. The propriety may be questioned, nevertheless no harm can result from clothing the actors or their setting with colors which appear to be appropriate because careful consideration and application of color even in the meager light of present knowledge will bring

results fully as commendable as those resulting from accident. It is said that these Greeks when presenting Homer's Odyssey, were clothed in purple garments to "signify the sea-wanderings of Ulysses"; and when acting the Iliad they were clothed in scarlet which was emblematic of the bloody battles characterizing that poem. Who can imagine Mephistopheles garbed in other colors than red and black?

Color has been used upon the stage to accentuate the mood, but relatively few instances have indicated more than a crude or indefinite attempt to use the language of color in correlation with the sentiment or action. Ofttimes omissions of other refinements closely allied to color in aiding in its expressiveness or in effecting the desired illusion as a whole have emphasized the crudity of the art. In the simple case of using colored light to produce the illusion of moonlight the almost universal lack of directedness of the light, and the consequent absence of definite and single shadows, have defeated the full realization of the results obtainable from the latent emotive power of color. Color has been correlated with the dance but apparently with no more depth of purpose than to appeal to the eye rather than to the intellect.

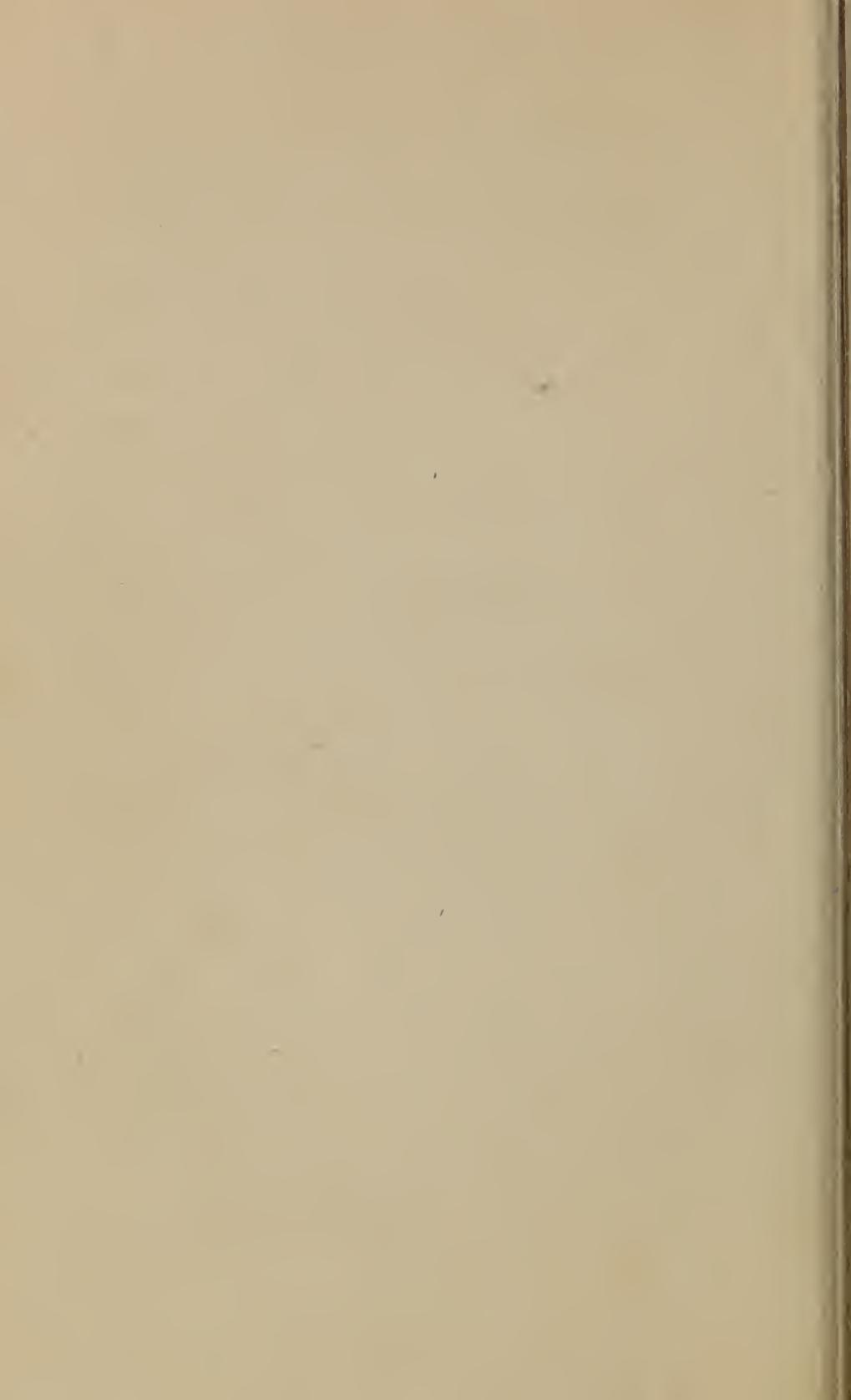
In the wonderful Russian ballet where th

beautiful accordance of setting, action, and music reached a high degree of perfection, it naturally might have been expected that the creative geniuses responsible for the production would have used color to the full extent of its power. Although the employment of line and color was conspicuously "modern," the use of color for its power alone was insignificant and it appeared that the creators either did not believe in the existence of such power or felt incompetent to employ it. It is possible they wisely restrained from going farther, governed by the principle that experiments are for private view. At any rate it is somewhat disappointing that those combined abilities responsible for the wonderful correlations of various arts—setting, action, story, and music—did not mix more of the language of color into the ensemble. It may appear that this statement is born of ungratefulness and, lest it be so construed, it should be added that it is doubtful if one was not already filled to capacity with the effects of the wonderful blend of setting, dance, and music. This raises the question whether additional use of the power of colors in such cases would not overtax the ability of the human organism to respond and therefore give rise to a detrimental reaction. This may be true when the visual sense is not

involved as in listening to music but when it is already in action it appears probable that the employment of colors properly correlated with the primary stimuli should result in heightening the emotional effect.

In the Russian dances many phases of our strongest emotions were portrayed. Love in many aspects, egotistical, selfish, weeping, passionate, spiritual, and joyful, was represented. Also distrust, revenge, shame, terror, folly, hope, victory, and happiness were portrayed. Such a gamut of emotions provides an excellent opportunity to utilize the powers of lighting and of color. This field represents one of great future possibility in employing the language of color in appealing to the intellect and in touching the emotional strings. The applications will be obvious to those who possess themselves of even the meager data available regarding the expressiveness of colors of which it is the aim of this book to present a glimpse. The subject of this chapter could be discussed to better advantage at the close of this book, but it has been incorporated here as a more generally befitting place in this review. After perusing the later chapters the possibilities of more definite uses of colors on the stage should be apparent.

PART II



SYMBOLISM OF COLOR

IT is the aim in this section to record a sufficient number of symbolic uses of various colors in order that the reader may obtain a general idea of the impressions which various colors have made upon the intellects of the past. An attempt is made to interpret the reasons for the adoption of the various significations, although these are recorded as concisely as possible. Reference should be made to preceding chapters in order to obtain a proper perspective because they contain brief discussions of various sources of our present rudimentary language of color and of the devious processes through which symbolic uses of colors have passed. The material presented in the following chapters of this section indicates the general character of our present knowledge of the expressiveness of color. The data are recorded as concisely as possible and care has been taken to eliminate repetition by choosing only a few examples of each use of color which appears to have a consistent and fairly well established symbolical meaning.

It is believed that brevity of treatment is

more conducive to attainment by the reader of a comprehensive view of the expressiveness of color than an extensive and involved treatment which would aim to prove that which is perhaps incapable of much further proof at the present time. The data which are recorded appear to represent generally accepted usages with a few exceptions. Inasmuch as the correctness of these significations cannot be ultimately proved, although extended argument would perhaps more firmly establish the justification of most of them and perhaps would cast some by the wayside, they are presented, with reservation, for what they are worth. This book is a condensed review of the products of thought and research in various directions which have been indulged in for the purpose of gaining an idea of the general impressions of color upon the intellects of mankind in general. The study was prosecuted largely for two reasons; first, to learn the possible effects of colors upon the human organism, and second, to strengthen or to destroy the ideas of a single mind regarding these powers of colors by gaining an idea of their effects upon civilized people in general. By no means is it admitted that the author's individual interpretations of the powers of colors will be cast aside entirely in future

applications of color, but an individual is justly subject to criticism if he does not consider the impressiveness and expressiveness of colors as recorded by the millions who have gone before. It is recognized that scientific research will doubtless contribute much in the future and possibly render untenable some of the arguments and conclusions incorporated in this book but instead of awaiting the returns of science it has appeared profitable to review briefly, and perhaps suggestively, the data which are available.

In the following treatment of the symbolisms of various colors only the simplest, or most common colors will be used as headings for various chapters. The looseness and lack of standardization of color terminology has caused great difficulties and it has been considered advisable to group various allied colors under a simple color-name. In some cases it has been necessary to interpret the color which is meant and doubtless others may not always agree. In doing so, however, advantage has been taken of intimacy with color terminology in its looseness and peculiarities as used by the layman, the artist, and others having various degrees of interest in colors.

Purple has been included either in the chap-

ter on the symbolism of red or in that of blue (violet) as appeared appropriate. This color has a just claim for individual treatment but, inasmuch as oftentimes it is called red (as in the case of blood) when it contains but a small blue component and sometimes blue or violet when it contains only a small red component, it has been divided between these two chapters. Included under the simple name, yellow, are a vast number of color-names closely allied, such as gold, orange, saffron, citrine, brown, etc. There are many browns, some bordering on red shades, others on yellow shades, and still others are close to black. These have been apportioned according to judgment. Green is more specific, yet it includes yellow-greens and blue-greens and such shades as olive. Blue is not so often confused as most of the other colors although violet and some of the bluish-purples are included under this color-name.

It is a striking fact that we have few names for the achromatic sensations and a great many for the chromatic sensations. The relative number of names in the two cases are not in the least proportional to the relative number of the two different kinds of sensations which we actually experience. This has the advantage of simplifying the treatment of black, white, and

gray from the present viewpoint. The three have been treated briefly in separate chapters and some of the common significations of combinations of black and white have been interspersed. Some of the dark shades of colors have been noted under black and gray. The justification of grouping the data under a few simple color-names is based upon simplicity. The use of the colors red, yellow, green, and blue is based on the distinctiveness of these colors in the spectrum. Purple does not exist in the spectrum but is fully as distinct as any of these four colors. It is entitled to separate treatment but, as already stated, it is used so confusedly and interchangeably with red, violet, and blue that it appeared the simpler and safer plan to incorporate it under red or blue as best suited to the individual case. These points are worthy of consideration if this subject be carried beyond the confines of this book. Successful application and interpretation of the expressiveness of colors will depend upon a broad acquaintance with the science of color which can be gained only partially through contact with books and theory. Contact with colors themselves in all their relations to the perceiving apparatus and to each other is necessary for a broad and intimate acquaintance.

RED

MANY symbolic uses of red have often arisen from an association with blood and thus red represents health, tragedy, anger and many attributes more or less allied by this association. Red has symbolized fire, heat, war, cruelty, and hatred, and has signified power and destruction. It has dyed the robes of royalty and martyrdom and the red flag has led many warriors into battle whether representing bravery, strength, or blood. The latter signification may share the responsibility for the universal acceptance of red as a danger signal along with the distinctiveness of this color and its relatively high purity in Nature. Some of the emotions, such as anger and shame, are accompanied by visible effects of blood which have given rise to definite significations of red. In its gentler offices, red is emblematic of love and truth, as well as of health and beauty. In such cases apparently it is not the spectral red but is usually a tint resulting from dilution with white and sometimes with the addition of violet. The former is a tint of red; the latter is usually a tint of purple, that is, a

rose or pink. Ofttimes the tint is clearly implied in such significations. Redness is indicative of the ardent passions as the blush of love and also of bashfulness or of shame. This color is often confused with purple or the latter term is used metonymically for red. In fact, the color of blood is a purple in which red greatly predominates. These pitfalls must be avoided in order not to experience confusion in attempting to analyze the various uses.

In the "Ode on the Passions" by Collins we find: Anger with "eyes on fire"; Revenge with "blood-stained sword"; and Cheerfulness "a nymph of healthiest hue." Spenser has decorated many vices and virtues with colors. For instance, Faleshood is "clad in scarlet red" and Praise-desire is clothed "In a long purple pall, whose skirt with gold was fretted." Middleton writes of the "bashful rose."

Satan has been clothed with red and black and these colors have symbolized purgatory and evil spirits. On the other hand, the red and white roses in the garland of St. Cecilia apparently signify love and innocence. Gosse paints Cupid's lips "more red than any rose." Aurora or Eos, "the rosy-fingered goddess of the morn," was the mother of stars, evening breezes, and the morning. She is represented

with rosy complexion and bright yellow robes. She rises from the streams of Ocean, is adorned with the color of the rose and pearls of dew and is drawn in a chariot by cream-colored horses to bring light to mankind. Sometimes the youthful and gayly-clad Horæ or Hours, are represented in her company. In Guido's "Aurora" the colors are in excellent accord with the succession of colors at sunrise. As an emblem of love and beauty the rose has sometimes been dedicated to the Virgin Mary. Red has been widely used in China at marriage ceremonies.

In Greek mythology we find that the Furie sprang into being from the blood of the mutilated Uranus. Ovid described the romance of Pyremus and Thiebe; the former was the handsomest youth, and the latter the fairest maid, of Babylonia. They had planned a meeting under a white mulberry tree but through a mistake each committed suicide under this tree. Their blood reached the roots of the tree so that the purplish-red hue mounted to the berries and henceforth the tree has borne "purple" berries.

In the Tales of a Wayside Inn by Longfellow Thor the thunderer, the strongest of gods among men, and the eldest son of Odin says,

"The light thou beholdest
Stream through the heavens,
In flashes of crimson
Is but my red beard
Blown by the night wind,
Affrighting the nations!"

The convivial qualities of Bacchus are often touched upon, for example, as in the following by Dryden,

"Flushed with a purple grace."

When purple inclines toward redness it has long signified royalty. In this respect it is a regal and pompous color and has been used for the robe of Jupiter and as a distinction of priestly superiority. It has been a symbol of heroic virtue and the Babylonians are said to have clothed their idols with it. It is used in mourning, especially in court mourning and in other affairs of state.

In a description of the musical contest between Pan and Apollo (the former having had the temerity to compare his music with that of Apollo) Apollo's "robe of Tyrian purple swept the ground."

Amethyst and violet have symbolized suffering, passion, love, and truth. Christ wears it after the resurrection, the Madonna, after the

crucifixion and, in general, penitents were clad in it. When red is diluted with white, and sometimes with blue, resulting in rose and pink it symbolizes beauty, love, and hope.) Hence the rose is the emblem of the goddess Spes and the Destinies and has been dedicated to the Virgin Mary. To look upon the world "through rose-tinted glasses" is synonymous to a cheerful, hopeful, and confident personality.

Red is a "warm" color of great power if such an expression is passable, however, when mixed with sufficient blue it becomes "neutral" and even "cold." It is the color given to courage and hence was a military color especially in the days when warriors trusted to valor more than to strategy and concealment. The red flag is associated with blood or danger and was the Roman signal for battle, hence "hang out the red flag" is a common phrase especially in early writing. Shakespeare signifies a challenge to battle thus,

"Stand for your own; unwind your bloody flag."

The heroes of old, such as Scipio and Hannibal, are said to have worn red shields, indicating strength, prowess, and courage. In the hands of the anarchist this color denotes defiance, hence the red flag is a symbol of an ex-

treme revolutionary party or of anarchy. This color is used as a danger signal in many distinct offices. It is supposed to affect animals in various ways, especially exciting the bull to rage.

“While Mars, descending from his crimson car,
Fans with fierce hands the kindling flames of war.”
—HALLER.

The poet sometimes applies purple to the color of blood with greater accuracy than is usual.

“Oft came Edward to my side
With purple falchion, painted to the hilt
In blood of those that had encountered him.”
—SHAKESPEARE.

“But when the flaming torch was hurled, the sign
Of purple fight, as when the trumpet sounds,” etc.
—EURIPIDES.

A poem inspired by the horror of the Great War by Margaret Widdemer contains,

“Ours is a dark Eastertide
And a scarlet spring.”

Shakespeare, who was a masterful word-col-
list, contributes many excellent symbolic uses
of color from which the following have been
elected:

"Thy ambition
 Thou scarlet sin, robb'd this bewailing land
 Of noble Buckingham."

"Thus conscience does make cowards of us all,
 And thus the native hue of resolution
 Is sicklied o'er with the pale cast of thought."

"And let's be red with mirth."

"I am the very pink of courtesy."

"He is come to ope
 The purple testament of bleeding war."

"If I prove honey-mouth'd, let my tongue blister,
 And never to my red-look'd anger be
 The trumpet any more."

"Beaufort's red sparkling eyes blab his heart's malice."

"How bloodily the sun begins to peer
 Above yon bushy hill! The day looks pale
 At his distemperature."



"Beauty's ensign yet
 Is crimson in thy lips and in thy cheeks
 And death's pale flag is not advanced there."

"'Tis beauty truly blent, whose red and white
 Nature's own sweet and cunning hand laid on."

Many other poetical examples of the symbolic use of red, or of colors closely related to it, are available, from which the following few have been selected:

“Celestial rosy red, Love’s proper hue.”

—MILTON.

“His (Cupid’s) lips, more red than any rose.”

—GOSSE.

“Would you know where young Love in his beauty reposes,
Go—seek for the boy in the Valley of Roses.”

—M. A. BROWN.

“The rosy-finger’d morning fair.”

—SPENSER.

“Morn,
Wakes by the circling Hours, with rosy hand
Unbarr’d the gates of light.”

—MILTON.

“For me the balm shall bleed, the amber flow,
The coral redder, and the ruby glow.”

—POPE.

—“The scarlet honour of your peaceful gown.”

—DRYDEN.

“He spoke; the goddess with the charming eyes
Glows with celestial red, and thus replies,”

—POPE.

“His hand did quake
And tremble like an aspen green;

And troubled blood through his pale face was seen
To come and go; with tydings from the heart."

—SPENSER.

RED CHEEKS

"Blooming youth and gay delight
Sit on thy cheek confess'd."

—PRIOR.

"In every breathing bloom I find
Some pleasing emblem of thy mind,
The blushes of the op'ning rose
Thy tender modesty disclose."

—RICHARDSON.

YELLOW

YELLOW and orange, their neighboring hues and various tints and shades are warm colors whose most striking characteristic perhaps is luminosity. The brighter colors are symbolic of light and warmth, and in this sense yellow is also gaudy, gay, lustrous, and enlivening. It is the natural emblematical color for the sun. In China, yellow has been quite extensively employed as a regal and sacred color. Perhaps for lack of euphony it appears often under the guise of golden, saffron, brown, sallow, tawny, orient, citrine, and many other names. The colors grouped here under yellow are very extensively employed by the poets in many variations of hue, tint, and shade.

As a symbol of light and warmth Aurora is clothed in “saffron robes.”

“Soon as the white and red mixt finger'd dame
Has gilt the mountain with her saffron flame.”

—CHAPMAN.

“Heaven's golden-wing'd herald.”

—CRASHAW.

Somewhat akin to this, Spenser arrays

Charity in "yellow robes" and the warmth of the hues allied with yellow is exemplified in,—

"Extremes alike in either hue behold,
Hot in the golden; in the silvery, cold."

—SHEE.

In the Ode to Passions, Collins refers to "brown Exercise" and similarly Thomson sings of,—

"The rustic youth, brown with meridian toil,
Healthful and strong."

In the sense of being glorious and lustrous it is often used thus,—

"And Fame, with golden wings aloft doth fly."

—SPENSER.

Yellow and its allied colors often denote harvest or fruition.

"The yellow harvest's countless seed."

—BYRON.

"Yellow, mellow, ripened days,
Sheltered in a golden coating."

—WILL CARLETON.

Gold has the additional conspicuous quality of brilliancy and metallic luster and often represents glory and power. Doubtless the intrinsic value of gold has largely influenced its symbolic use.

The cross is often of gold and the five wounds of crucified Christ sometimes are represented by inserting as many rubies, one in the center of the cross and one at each extremity. Silver is also employed in this respect. The gold and silver are perhaps symbolical of light, brightness, and sanctity. Yellow or gold has been emblematic of the sun, of marriage and fruitfulness and of God's goodness. In some representations St. Peter and St. Joseph are clothed in yellow.

The glory, aureole, and nimbus usually painted in yellow or gold, represent brilliancy, light, and sanctity. The aureole surrounds the whole body, and the nimbus encircles the head. The glory is a combination of the two. Strictly, only persons of the God-head were endowed with the aureole, but the Virgin Mary is invested with it in representations of various events. The glory belongs to the Virgin as well as to God. The nimbus belongs to all saints and holy persons. These symbols began to appear in Christian art about the fifth century and their color in all great painting is golden, symbolic of light, glory and divine power. In miniatures sometimes these symbols have been painted different colors. It is believed by some that the colors are symbolical, but nobody

versed in the art and traditions of Christianity has ventured an analysis.

(Orange or brown in the darker and less beautiful shades appear to be used sometimes as emblems of distrust or deceit, and yellow is sometimes associated with indecency, morbidity, decay, cowardice, and indecent sensationalism as in the case of "yellow journalism." Yellow is used to clothe various malign passions. A yellowish complexion often indicates illness and this same color, usually with a greenish tinge expressed or implied, is very generally used as a symbol of jealousy.) Examples of the foregoing are:

"The cynosure of jaundiced eyes."

—SHAKESPEARE.

"I will possess him of yellowness."

—*Idem.*

"Jealous piques,
Which th' ancients wisely signified
By th' yellow mantoes of the bride."

—BUTLER.

"And Jalousie
That wered of yelw colors a gerlond
And had a cuckow sitting on hir hond."

—CHAUCER.

"O jealousy,
Thou ugliest fiend of hell! thy deadly venom
Preys on my vitals, turns the healthful hue
Of my fresh cheek to haggard sallowness,
And drinks my spirit up!"

—HANNAH MORE.

"And jealousy, suffused with jaundice in her eyes,
Discolouring all she viewed."

—DRYDEN.

The dingy yellow or brown, such as often distinguishes the garments of Judas, signifies, besides jealousy, deceit and inconstancy. This color has also been used in the past to mark the abodes of traitors and other criminals.

"His very hair is of the dissembling colour
Something browner than Judas's."

—SHAKESPEARE.

Yellow is also associated with sickness and disease, hence the yellow flag is used as a sanitary signal being displayed on vessels having on board cases of infectious or contagious diseases. It serves this office on quarantined ships and houses and has indicated hospitals in time of war. In the latter case it assumes the rôle of protector.

Orange apparently has partaken of many of the qualities of the colors related to it and is used in a corresponding manner.

Brown, which inclines toward red and black, is more grave. It signifies strength, solidity, vigor and, to some degree, sadness. The "melancholy days" of autumn are painted largely in a brown key. This color, in perhaps

an extreme application of the preceding, is regarded by some as emblematic of sluggishness. In Nature it represents maturity.

GREEN

GREEN is employed to signify youth and vigor perhaps through the association of green with the spring of the year. At least green is more impressive in spring because of its newness. It also has been used to express hope and victory, and olive, a green shade, is symbolical of solitude and peace. As compared with other colors of the spectrum it is relatively neutral and some of its symbolic uses appear to be the result of the prominence of this characteristic. (To poets, green is indicative also of cheerfulness, as "cheerful green," plenty, life, and immortality, and through its association with the spring of life it is widely used as a symbol of inexperience.) When green is tinged with yellow it apparently assumes some of the attributes of yellow. It also is used throughout poetry in the same relative abundance as it is found in nature, although the pure symbolic uses do not appear to be as numerous as might be expected perhaps owing to its neutral characteristic.

(Green as the color of spring is an emblem of hope, victory and plenty.) Verdure indicates

life and hence green is emblematic of immortality. Saturn is crowned with evergreen, and the custom of strewing green foliage upon graves is consistent with this analogy as is the adornment of Poets and Time with fillets of green. This color also signifies Youth, the spring of life. In Ovid, Apollo says to the laurel tree into which Daphne whom he loved was transformed,



"And as eternal youth is mine, thou also shalt
Be always green and thy leaf know no decay."

This color has also denoted memory and in a few early instances was held to be sacred or a holy color. The poets have used this color extensively according to analogy, fancy, and to its use in Nature. In mythological representations the hair and garments of Neptune, the Dryades, and the Naiades are dyed with green. It is of interest in passing to note how color may become woven into the traditions of a people and cherished in the extreme chiefly to continued association. For example green means far more to the Irish race than to other civilized peoples at the present time.

In liturgy green denotes faith, immortality, resurrection of the just, and gladness of the faithful. In some churches green is used for

Easter and in mediæval days was associated with the Feast of the Trinity. In these offices the color perhaps signifies the rejoicing of the faithful. As an ecclesiastical color it prevails in one church from Trinity to Advent Sunday.

The following are a few selected examples from the poets:

“You are too wise in years, too full of counsel,
For my green experience.”

—FORD.

“My salad days,
When I was green in judgment, cold in blood.”

—SHAKESPEARE.

“The memory be green.”

—*Idem.*

“That yon green boy shall have no sun to ripe
The bloom that promiseth a mighty fruit.”

—*Idem.*

“While virgin Spring, by Eden’s flood,
Unfolds her tender mantle green.”

—BURNS.

“Green is indeed the color of lovers.”

—SHAKESPEARE.

“And with a green and yellow melancholy,
She sat like Patience on a monument,
Smiling at grief.”

—*Idem.*

“O, beware, my lord, of jealousy,
It is the green-eyed monster, which doth mock
The meat it feeds on.”

—*Idem.*

“Eternal Spring, with smiling Verdure here
Warms the mild air, and crowns the youthful Year.”

—GARTH.

“But he her fears to cease
Sent down the meek-eyed Peace;
She, crown’d with olive green, came softly sliding
Down through the burning sphere.”

—MILTON.

“The wreaths of cheerful May.”

—COLLINS.

“Where Peace, with ever-blooming olive, crowns
The gate where Honour’s liberal hands effuse
Unenvy’d treasures.”

—AKENSIDER.

“In jealous Pisa’s olive shade!”

—COLLINS.

Sometimes green is used to signify illness but
doubtless in all cases the word is used for eu-
phony instead of yellow-green. In cases of
this character the tint is usually clearly implied.
For instance,—

“To look so green and pale.”

—SHAKESPEARE.

BLUE

THE quality or attribute most striking in blue is coldness and, as is true of other colors, it communicates this property in varying degree to all colors which contain blue components. Another conspicuous characteristic of its proximity to black. Many of the symbolic uses of blue apparently have arisen from its property of coldness and from the association of blue with the firmament. From its coldness it is characterized as dignified and soothing; from its shadowy nature it signifies sedateness and melancholy; and doubtless, from being the color of clear sky it has been associated with heaven, hope, constancy, fidelity, serenity, generosity, intelligence, and truth. In many respects it is opposed to orange or yellow, its complementary. In an ancient doctrine the hue of the sky is supposed to be a compound of light and darkness. The expression of "true-blue" for constancy and fidelity is commonly used and perhaps originated with mariners from associating the blue sky with freedom from storms. Hope is "clad in blue" by Spenser. Minerva is often clothed in blue robes and

personifications of Poetry have been draped in this hue. In Nature, the blue sky is conspicuous and has affected some primitive people deeply. The association of blue with the heavens doubtless has been responsible for the symbolic use of this color for divinity, divine love and supreme intelligence. In a similar manner, combined with the belief that "the eye is the window of the soul" blue eyes have been symbolic of intelligence. This color also has been associated with the learned or pedantic and aristocratic as "blue-blooded."

"Some ladies were very blue and well informed."

—THACKERAY.

Blue is a conspicuous color in many representations of biblical events. Christ, the Virgin Mary, and St. John have often been clothed in mantles of blue. This color is also prominent in mythological representations. The veil of Juno, the goddess of air, is blue; Diana or the Moon is clothed in blue and white or silver robes; and Isis of the Egyptians and her priests have been clad in "pure azure." Minerva, who in Homer's *Odyssey* is "azur eyed," is distinguished by a mantle of blue. She sprang from the brain of Jove and, although being the goddess of storms and wa-

was also possessed of a fair and thoughtful nature. She was eternally a virgin and goddess of wisdom, generosity, and thought. Hence,

“The blue-eyed progeny of Jove.”

—DRYDEN.

In his poem, *Venus of Milo*, E. R. Sill sings,

“The tremulous rosy morn is her mouth’s smile,
The sky, her laughing azure eyes above.”

In liturgy blue is symbolical of hope, love of divine works, Christian prudence, a serene conscience, sincerity, divine contemplation, and piety. Blue robes have been worn by priests at the grave and it is believed that the color used in this case is symbolic of heaven. The Levites wore this color as the livery of heaven.

The attribute of harmony is sometimes bestowed upon this color. For instance,

“Where’er we gaze,—around, above, below,
What rainbow tints, what magic charms are found!
Rock, river, forest, mountain, all abound,
And bluest skies that harmonize the whole.”

—BYRON.

Blue is often associated with coldness and melancholy and with dismal and unpromising prospects.

"Oh, coward Conscience! how dost thou afflict me!
The lights burn blue!"

—SHAKESPEARE.

"The pale violet's dejected hue."

—AKENSIDE.

Other symbolic uses of this color by the poets
are exemplified in the following:

"Long, Pity, let the nations view
Thy sky-worn robes of tend'rest blue,
And eyes of dewy light."

—COLLINS.

"And heal the harms of thwarting thunder blue."

—MILTON.

WHITE

IT is not surprising to find white used as symbolic of light, purity, chastity, innocence, truth, modesty, and peace. In a somewhat allied sense, in which the attribute of physical weakness predominates, it is emblematic of femininity, delicacy, and infirmity, which usage doubtless arises from the association of a pale complexion with ill-health, lack of stamina, or a delicate constitution. White is synonymous to unadulterated or unchanged light and its attributes are obviously quite opposed to those supposed to be possessed by black.

To Jupiter, the Roman lord of heaven and of light, white was sacred. White horses drew his chariot and white animals were sacrificed to him by consuls who were clothed in this color. His priests were crowned with white head-gear. The white vestments of priests and of the Pythagoreans were emblematic of peace and purity. The lily has often been used to signify chastity and belongs to St. Antony of Padua, St. Catherine of Siena, St. Casimir, St. Clara, and others. The crucifix entwined with lilies has been bestowed upon St. Nicholas of Tolentino.

tino and upon many who especially dedicated themselves to the Virgin Mary. White is worn by the latter in representations of the Assumption and by Christ after his resurrection. White as the color of purity and joy is used on the festivals of Christ, Mary, the angels, and unmartyred saints and also at marriages. In Anglican churches this is the prevailing color throughout Eastertide.

White is often emblematic of humility and when worn by the judiciary symbolizes integrity. In old Roman paintings, Friendship has been draped in white. Truth has been idealized by a woman holding lilies. Venus, the goddess of love and beauty, was the daughter of Jupiter and Diana and, according to one version, she sprang from the foam of the sea at the time of the wounding of Uranus. She is therefore called Aphrodite, the "foam born," by the Greeks. The Hours and the Graces wove robes for her that "reflected the hues and breathed the perfumes of crocus, hyacinth, violet, rose, lily, and narcissus." Poetry has been personified holding white roses and Roman poets clothed their god, Pietas, in white. Spenser writes of the "virgin lilie" and Middleton likens the "holy dew of prayer" to a pearl. Owing to its eminent luminosity, white is used

to enliven without the aspect of gayety. We also have the white flag of surrender and of peace, the "white feather" of timidity and the white shield of untried manhood.

In liturgy white quite naturally symbolizes purity, temperance, innocence, and as a background for figures of saints signifies chastity. In China, white is the color used in mourning.

Examples of symbolic uses of this color by the poets are,

"White-robed innocence."

—POPE.

"The snowy wings of Innocence and Love."

—AKENSIDE.

"As chaste as unsunn'd snow."

—SHAKESPEARE.

"Now, by my maiden honour, yet as pure
As the unsullied lily, I protest."

—*Idem.*

"Dark-wounding Calumny
The whitest virtue strikes."

—*Idem.*

"Thou tremblest, and the whiteness on thy cheek
Is apter than thy tongue to tell thy errand."

—*Idem.*

"Yea Jupiter! But why this mortal guise,
Wooing as if he were a milk-faced boy?"

E. R. SILL.

“White robed truth.”

—MILTON.

“The saintly veil of maiden white.”

—*Idem.*

“White as thy fame and as thy honour clear.”

—DRYDEN.

“By the semblance
Of their white flags display'd, they bring us peace.”

—SHAKESPEARE.

“My hands are of your color, but I shame
To wear a heart so white.”

—*Idem.*

BLACK

AS might be expected, the symbolic uses of black have been quite opposed to those of white. It has signified woe, gloom, darkness, dread, and death and, in a severer aspect, terror, horror, wickedness, and crime. When used with white, the latter appears to rid it of its baseness or to tone its severeness. In this combination it has been variously used to symbolize humility, melancholy, resolution, solemnity, secrecy, and prudence. Among civilized people it has been for ages the ensign of woe, mourning, and death. It is the most retiring of colors and in painting it has been used to express solemnity, profundity, and endless extent. The "black sheep" signifies an individual different than the rest and usually in an uncomplimentary sense. This color is variously applied suggestively as "black tidings," "black Friday," "black aspect," "black augury," and "black looks." The black flag is associated with piracy and with warfare when no quarter is to be given. Spenser clothes Idleness in a "habit black."

It is said that the ancient sculptors executed

statues of Jupiter, the terrible, in black marble and of Jupiter, the mild, in white. Pluto's chariot was supposed to have been drawn by black horses, and black sheep were sacrificed to him. Odin, a great and severe god in Northern mythology, rode a black horse as Gray says,

“Uprose the king of men with speed
And saddled straight his coal-black steed.”

Black was the garb of the Harpies and the Furies, the daughters of Night. In mythology, Mors, or Death, is represented with pale face and clad in black garments. Somnus, god of sleep and brother of Death, is draped in black, and statues of him were often made of ebony and black marble. Night, the mother of all these figurative beings, is clad in a black mantle studded with stars, has sable wings, and is sometimes drawn in an ebony chariot.

“Eldest Night
And Chaos, ancestors of Nature.”

—MILTON.

“Sable-vested Night, eldest of things.”

—*Idem.*

“Night with her sullen wings.”

—*Idem.*

“O thievish night.”

—*Idem.*

"Ghostly, grim and ancient Raven, wandering from the
Nightly shore,
Tell me what thy lordly name is on the Night's Plutonian
shore!"

—POPE.

But night has another aspect; its silent, starry, endless expanse awakens imagination. Who has gazed at the studded sky in the silence of midnight who has not imagined as at no other time? Imagination is another world and the nearly infinitely distant stars, as attracting magnets, seem to draw the imagination far into another world. At no other period of the day is the purely imaginative mood so fostered as at night with its freedom from distractions.

It has been stated that ancient poets and painters represented Hesperus, or evening, "as a double investiture of light and shade." As Lucifer and Phosphorus they give him a white horse, and as Hesperus a black one. Black has been associated with witchcraft and from its association with mystery arose the term "black art."

In northern mythology, the white spirits or Elves of Light, according to Bulfinch, were "fair, more brilliant than the sun, and clad in garments of delicate and transparent texture." They lived in the domain of Freyr, the god of

the sun, and sported in light. "The black or Night Elves were a different kind of creature. Ugly, long-nosed dwarfs, of a dirty brown color, they appeared only at night. Their language was the echo of solitudes, and their dwelling places subterranean caves and clefts." Black is often given to Satan symbolizing wickedness and death.

Examples of the symbolic use of black by Shakespeare are:

"Look'd black upon me; struck me with her tongue,
Most serpent-like, upon the very heart."

"Nor customary suits of solemn black."

"Arise, black vengeance, from thy hollow cell."

"How now, you secret, black, and midnight hags?"

"News fitted to the night,—
Black, fearful, comfortless, and horrible."

"Youth no less becomes
The light and careless livery that it wears,
Than settled age his sables and his weeds,
Importing health and graveness."

"Taking thy part, hath rush'd aside the law,
And turned that black word death to banishment."

"Black lust, dishonour, shame, misgoverning."

"And beauty dead, black chaos comes again."

“Black is the badge of hell,
The hue of dungeons and the scowl of night.”

The power of black in poetry is strikingly shown in the following to be equal to its power in painting:

“Hence, loathed Melancholy,
Of Cerberus and blackest Midnight born,
In stygian cave forlorn,
'Mongst horrid shapes, and shrieks, and sights unholy,
Find out some uncouth cell,
Where brooding Darkness spreads his jealous wings,
And the night-raven sings;
There, under ebon shades, and low brow'd rocks,
As ragged as thy locks,
In dark Cimmerian desert ever dwell.”

—MILTON.

Other symbolical uses of black are presented in the following examples:

“Not the black gates of Hades are to me
More hostile or more hateful, than the man
Whose tongue holds no communion with his heart.”

—SYDENHAM.

“O'erlaid with black, staid Wisdom's hue.”

—MILTON.

“There the black gibbet glooms beside the way.”

—GOLDSMITH.

“The black and doleful ebonie.”

—SPENSER.

"Black tidings there,—blacker never came to New England."
—HAWTHORNE.

"A great black swamp and evil smell."

—TENNYSON.

Black is one of the most important pigments to the artist. It combines well with all colors and this characteristic has sometimes led to its symbolical use occasionally in a harmonious sense seemingly inconsistent with other uses if this attribute is not recognized. It harmonizes well with the gayest colors and the representation of the goddess Flora in a black mantle is appropriate in this sense. Gray has beautifully expressed this idea thus:

"The hues of bliss more brightly glow,
Chasten'd by sable tints of woe;
And blended, form with artful strife,
The strength and harmony of life."

GRAY

IN many respects the expressiveness of gray partakes partially of the attributes of both black and white and is sometimes a well-defined mean of their characteristics. It is the color of penance, humility, sadness, age and matured judgment. Spenser speaks of Humbleness as "aged sire, hoary gray" and of Reverence, "cleanly clad in comely sad attire." In Nature it is oftentimes considered cool, retiring and suggestive of distance. The skies of winter and of rainy days are often of a grayish or leaden color and the dreariness associated with such bleak periods of "leaden dullness" appears to have been inherited by this color. To Thomson, Winter is "sullen and sad" as he "spreads his atest glooms" and many poets share a similar sentiment regarding this season. The approaching night, with its "twilight gray" associated with quietude and a note of sobriety or sadness, has lent its assistance in attaching these attributes to this color.

According to their traditions, the Dominicans wore a habit requested by the Virgin Mary. This was composed of black and white, the

former symbolizing mortification and the latter purity. Various monastic orders wear black, gray and brown in different combinations. It is noteworthy that the colors were invariably neutral or nearly so. The Greeks often represented Jupiter clothed in the skin of a gray goat.

Gray apparently takes a consistent place between black and white according to its usage by the poets as might be suggested in these lines by Pope,

“If white and black blend, soften and unite
A thousand ways, is there no black and white?”

It has been used to signify humility, penance, piety, matured judgment, sobriety, fear, and death. As already stated, it appears to assume attributes similar to those of its components, black and white, even when the latter are unmixed but used simultaneously. As a background for paintings of saints it signifies tribulation.

“Let hoary Judgment, sober guest,
Bring Candour in her lilyed vest.”

“Now came still evening on, and twilight gray,
Had, in her sober livery, all things clad.”

—MILTON.

“For all was black, bleak, and gray,—
It was not night—it was not day.”

—BYRON.

“Gray-headed men and grave warriors mixt.”

—MILTON.

“Oh! how unseemly shews in blooming youth
Such grey severity.”

—*Idem.*

“The roses in thy lips and cheeks shall fade
To paly ashes, thy eye’s windows fall.”

—SHAKESPEARE.

VARIOUS COLORS

IN closing this section, in which it has been the aim to discuss the expression and symbolism of colors by means of data as definite as obtainable, a few illustrations of the use of light and colors in various combinations will be presented. Some of these examples will be selected from the poets who exhibit a wonderfully refined feeling for color in painting their many vari-colored sketches. They also reveal a highly developed sense of appropriateness in the application of color and a masterly skill in contrasting and in harmonizing colors. The latter viewpoint is not of direct interest in the present work but it is of interest in passing. In some of the following examples colors have been used symbolically although more or less vaguely.

“Seest how fresh my flowers been spread,
Dyed in lily-white and crimson-red,
With leaves ingrained in rustic green,
Colours meet to cloathe a maiden queen.”

—SPENSER.

“To thee, sweet smiling maid, I bring
The beauteous progeny of spring;
In every breathing bloom I find

Some pleasing emblem of thy mind.
 The blushes of that op'ning rose
 Thy tender modesty disclose.
 The snow-white lilies of the vale,
 Diffusing fragrance to the gale,
 No ostentatious tints assume,
 Vain of their exquisite perfume;
 Careless, and sweet, and mild, we see
 In them a lovely type of thee."

—RICHARDSON.

"There is something in the autumn that is native to my blood—

Touch of manner, hint of mood;
 And my heart is like a rhyme
 With the yellow and the purple and the crimson keeping time."

—W. B. CARMAN.

Ofttimes the word, color, is used suggestively as in the following,

"Colouring with astonishment and disdain."

—JANE AUSTEN.

"Figures of poerie
 Or coloures of rethorik."

—CHAUCER.

The lamp, lantern and taper are often the symbols of piety, but according to Clement the lamp as the attribute of St. Lucia signifies heavenly wisdom or spiritual light. Fire and flames are sometimes emblematic of zeal or the sufferings of martyrdom. The flaming heart

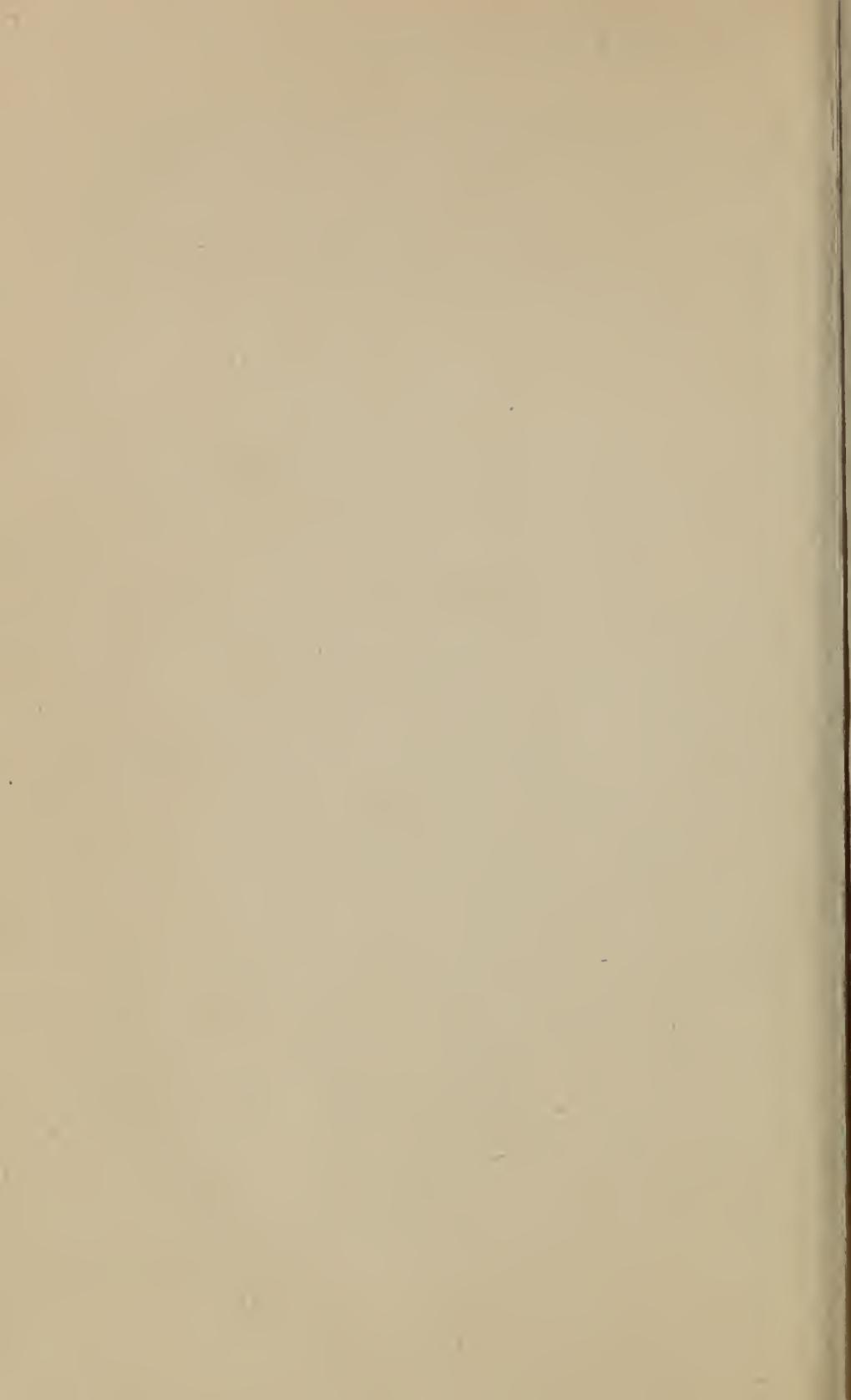
most frequently signifies piety and divine love. Isis, the goddess of the rainbow, is represented as the messenger of the gods.

In the Library of Congress, Carl Gutherz has painted a pictorial spectrum of light which consists of idealizations of the seven principal colors. The significations are not all clear but they are presented here for reference. Violet (akin to purple) is the light of State; indigo, the light of Science; blue, of Truth; green, of Research; yellow, of Creation; orange, of Progress; and red, the light of Poetry.

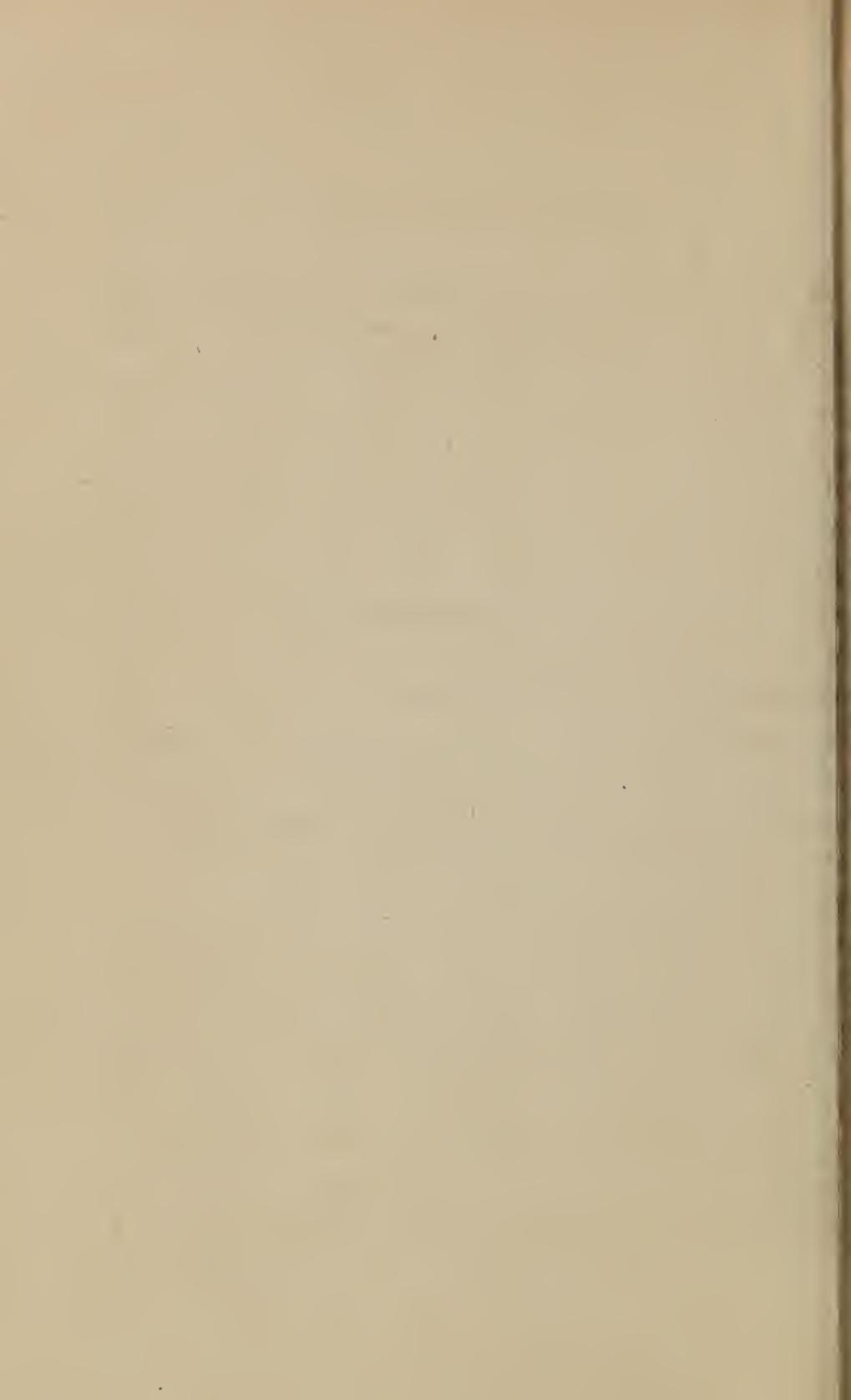
In some representations a glory of angels surrounds Christ, the Virgin or the Trinity. The Seraphim and Cherubim are symbolized by heads with one to three pairs of wings and painted blue or red. According to Clement, "the Seraph, whose name symbolizes 'to love' should be red, and the Cherub, whose name signifies 'to know' should be blue." White is usually the prevailing color of angels' robes.

Some artists and writers have noted that the human countenance is a masterpiece of the natural expression of colors. As indicated in the preceding, redness accompanies anger and the ardent passions, the blush signifies bashfulness or shame, yellowness is the result of illness, grief, and envy, and blueness is due to

ear, terror, hate, agony, and death. Whether or not scientific investigation will support all of the foregoing, these ideas are prevalent and have been woven into mythology, art, and literature for many centuries.



PART III



NOMENCLATURE

AMONG the various phases of the science of color the most discouraging chaos is found in the state of color terminology. Even among the various sciences interested in color, such as physics, physiology and psychology, the terms which are used for different color qualities are far from being standardized and universally definite. Upon turning to the vocabularies of artists and laymen the terminology is found to be so indefinite and misapplied as to leave one bewildered and quite incapable of determining the exact meaning of many of the terms which are used. This state of affairs is the more disappointing because the various color quantities or qualities are well established and readily defined scientifically. Furthermore, the science of color cannot boast even of a rudimentary scheme of notation. To make the meaning clear let us consider music. The nomenclature of sounds is very definite, well established, and almost universally accepted. In order to connect and to harmonize tones into music, a system of notation—the musical scale—was adopted, thus making printed music a universal

language at least among the more highly civilized peoples. This standardization has not reached all parts of the earth, but has spread and taken root in a remarkable manner when compared in this respect to the nomenclature of color. Of course it took many centuries for the terms of the science of tones and of the art of music to reach their present highly standardized and readily interpretable state, but colors have been used for centuries without more than a rudimentary beginning of a standardization of the nomenclature.

It appears not only profitable but necessary to insert at this point a brief discussion of color and of color terminology not only for the purpose of aiding the reader in understanding clearly other chapters but to spread the propaganda of standardization. The terminology considered here will be that which has been acceptable to the physicist for many years. This appears justifiable because the terms seem to meet the requirements of other scientists as well as artists and, furthermore, the physics of color is in a higher state of development than other aspects of the subject.

Before discussing terminology, the fundamentals of color will be treated briefly. Light rays can be decomposed by a prism or by a dif-

fraction grating into colored rays. Investigation has revealed the fact that the radiation from a light-source, such as the sun, consists of disturbances of various wave-lengths (in a hypothetical medium called the ether) some of which, when impinging upon the retina of the eye, are capable of arousing the sensation of color, depending upon the wave-length or frequency of the vibration. The rays of shortest wave-length (highest frequencies) which are visible produce the sensation of violet and the longest visible wave-lengths (lowest frequencies) produce the sensation of red. Intermediate wave-lengths, from the shorter to the longer, produce respectively the sensations of blue, green, yellow and orange. It will be recognized that the spectrum has been described and that these colors are known as the spectral colors.

Under favorable conditions the rainbow is produced in Nature, which in reality is the spectrum of sunlight. Although many different hues are visible in the spectrum besides those represented by the foregoing simple color-names, a large class of colors, namely, the purples, has not been mentioned. These do not exist in the spectrum but are the result of the synthesis of the violet or blue and red sensations.

This brings us to the matter of color-vision which will be touched upon briefly here but more elaborately in the chapter on the Psycho-physiology of Color. The eye is not an analytical instrument but a synthetical one. In other words a given sensation of light or of color is the integral effect of radiation of many wave-lengths except in the case of pure spectral colors. For example, white light is the integral effect of all visible wave-lengths in daylight or, in special cases, is the combined effect of complementary wave-lengths. Another example is the sensation of yellow which can be caused in three ways: first, by a certain wave-length in the spectrum; second, by a mixture of green and red lights of proper intensities; and third, by the integral effects of various wave-lengths such as are commonly reflected by yellow pigments, in which cases the wave-lengths exciting the sensation of yellow predominate. These three ways of producing the sensation of yellow are only general classifications because there are many combinations of wave-lengths in the last two whose integral effects result in arousing the sensation of yellow.

It is also well known that proper mixtures of red, green, and blue lights, when acting simultaneously upon the retina, will produce a color

less sensation or white. Many such examples could be presented but these are sufficient at present to show that the sensations of color, even of simple colors, are complex when considered from the viewpoint of the stimuli.

It is well to bring to attention the difference between spectral colors and the colored lights and pigments ordinarily encountered. Spectral colors are produced by radiation of single wave-lengths, or nearly so. This is never true of the colors of pigments or of colored lights ordinarily available. Pigments generally reflect rays of many wave-lengths and colored lights usually consist of rays of many wave-lengths.

Two distinct kinds of color terminology are necessary to meet all requirements. The science of color requires a terminology and notation based upon the spectral characteristics of colors because spectrum analysis is of fundamental importance. However, from the viewpoint of this book we are concerned chiefly with what the eye sees, so that the actual spectral characteristics will not be considered here.

Turning then to colors as the eye sees them, hue is the first important color quality. Ordinary colors, with the exception of purple (which includes pink, rose and allied colors), have a

dominant hue which corresponds to a spectral color. Hue is, therefore, that quality of a color which is correlated on the physical side with wave-length or frequency of light waves. In the case of purple, which has no match in the spectrum, the hue of its complementary can be associated with it in scientific data.

After matching the given color with its corresponding spectral hue and equating the two in brightness, it is seen that the two colors do not generally appear alike. They now differ in saturation or purity and by mixing a proper amount of white light with the spectral color an apparent match can be obtained. Most pigments reflect a sufficient range of wave-lengths on either side of the maximum so that the color is diluted with a certain amount of white light. This is also generally true of transparent colored media or of colored lights. The fraction of white light, which has been added to the spectral hue to produce a match with the color being analyzed, when subtracted from unity gives a measure of the purity of this color. Thus the saturation or purity of a color is dependent upon the amount of white light associated with it. A spectral color is of one hundred per cent. purity on this basis and white represents the other extreme or zero per cent.

purity as a color. In analyzing a purple by this method a spectral color is mixed with the purple to make white and the remaining procedure is obvious.

The third quality of a color as considered from the standpoint of what the eye sees is brightness. For purposes of analysis this factor can be measured in relative or in absolute units depending upon the requirements. Thus, it is seen that the three qualities of a color are hue, saturation or purity, and brightness.

Only two other terms are necessary to complete a simple color terminology of considerable effectiveness and descriptive power. If a spectral hue or a pigment be diluted with white it becomes less saturated or of lower purity and is called a tint. For example, the light from a candle flame is a tint of yellow, that is, a yellow of low purity or saturation; a pink is an unsaturated purple; and the blue sky is a tint of blue. In other words, tints of a certain hue are produced by varying the saturation.

Shades are produced by reducing the brightness of a color. This can be accomplished in two ways: first, by decreasing the illumination of a color it becomes a darker shade; second, by mixing a "perfectly black" pigment with a given color, a shade of the latter is produced.

Thus with the terms, hue, saturation, brightness, tint, and shade, a terminology of very extensive application is available. Many of the indefinite or not widely used terms can be discarded without sacrificing anything but an undesirable confusion. Doubtless certain general terms now used in the vocabularies of the artist can be retained to advantage but most of the requirements of color terminology are well met by the five foregoing terms. At least descriptions of color should be confined as closely as possible to the five terms or similar ones. It appears that these are worthy of adoption because they emanate from the most firmly founded branch of color.

Other methods of analyzing color are available, notably the method which matches a given color by mixing proper proportions of red, green and blue lights. This method is based upon an experimental fact of color-mixture but is less desirable as a basis for the terminology of color because the results cannot be readily visualized in terms of the appearance of a color. The method of analysis which yields results in terms of hue, saturation, and brightness is more promising because the data are more easily visualized in terms of what the eye actually sees on viewing the colors.

Regarding the notation of color there is little to discuss beyond stating that there is no scientifically founded notation available at present though commendable schemes have been proposed. The one which best fits into the terminology favored by the author makes use of the measurements of hue, saturation and brightness. This scheme of notation which has been advocated by various persons interested in color, notably Munsell, would perhaps require that the saturation and brightness scales be divided empirically but referred to certain standards. For instance R_7^6 , would represent a red color whose brightness is 6 and whose saturation is 7, both these numbers being stations on empirical scales. Perhaps ten stations on each scale would be sufficient and in this case the above notation would represent a red color whose brightness was 0.6 of the brightness of perfect white under equal illumination, the brightness of the white being considered as 10 units. Relative brightness in this case is sufficient. The wave-length of the dominant hue could be associated with, or substituted for, the letter *R*, which would indicate the dominant hue specifically.

The data so far would be meaningful. A spectral color could be represented by 10 units

or complete saturation and in the foregoing case the color would be 0.7 saturated or would have 0.3 white mixed with it. Adherence to the foregoing terminology and notation would insure against the present chaotic condition. It is doubtless too early to expect the adoption of such scientific notation because scientists must first present data in these terms, but there appears no reason for not using the terminology described above or terms akin to these instead of the variety of indefinite terms now in use.

The number of different color sensations which we are able to experience has not been determined even approximately but from various modes of attack this number can be shown to be as large as several hundred thousand. Certainly the future cannot depend upon individual color-names for the correct designation of these colors. This emphasizes the need of a systematic system of color notation.

Chromatic sensations differ from achromatic sensations in that they form a closed series. That is, the former may be placed in a continuous series, as is commonly done, about the circumference of a circle or the periphery of a square. Beginning with red, we can pass through the spectrum to the violet and close the

remaining gap with the purples varying from a violet-purple to a reddish one. The arranging of various colors in certain relations upon geometrical forms is merely for convenience in visualizing the variations and relations of colors which are perceptible to the eye. Both plane and solid geometrical forms have been used, among them being the square, circle, equilateral triangle, pyramid, cone, cylinder, sphere, etc. The use of such forms is highly commendable as an aid in arranging colors in certain sequential relations but it is a mistake to press these geometrical dimensions and relations too far into the theory of color. Many ingenious adaptations of solid geometrical forms have been made for providing arrangements of the spectral colors and all their tints and shades in certain approximate relations which can be visualized as a whole. In order to account for certain physiological and psychological peculiarities it is necessary to modify these figures into somewhat irregular and asymmetrical forms.

Achromatic sensations do not form a closed series. If we begin with white and pass through the grays we finally reach black, but nothing remains with which to fill the gap from black to white again unless the series of grays be re-

peated in reversed order. This difference is significant in dealing with colors in many of their uses as touched upon in this treatise.

We are able to distinguish fewer spectral hues than achromatic sensations, yet we have a great many more names for the former. If all the tints and shades of colors be included with the perceptibly different hues the number of chromatic sensations that can be experienced is greatly increased. As previously stated, the exact number has not been determined experimentally but it is possible to compute approximate values which mount as high as several hundred thousand.

Between white and black it is contended that we can experience more than six hundred different sensations. Psychologists do not agree as to whether or not the colorless sensations differ in quality as well as in intensity. Wundt believes they differ only in intensity but some psychologists, notably Titchener, contend that they differ also in quality. The latter contend that a gray can differ from another in two important characteristics; it may be lighter (or darker) and it may also be brighter (or duller). It is possible that the latter characteristic can be considered merely a physical one possessed by the object and consequently there

is some question as to the acceptability of this characteristic as a quality of sensation. Color (in the narrow sense of the term) is accompanied by emotions and by strong sentiments to a much greater extent than neutral grays (mere brightness) but both have their functions in the language of color. It is simpler to discuss each separately and this procedure is therefore adhered to whenever it is possible.

In the foregoing, the discussion has been confined largely to the science of color nomenclature for the purpose of defining the terms upon a rigid foundation. Pertinent data concerning color-names and their evolution are found in the chapter on Primitive Language. It is well to consider that chapter as an introduction to the present one. In reflecting upon our color notation it is interesting to select from the great mass of words, which are used to describe or to designate colors, those words which are abstract color-names and to select from these the names which apply directly to the spectral colors. If, in connection with this study, observations will be made on the ability of the average person to describe colors, it will be concluded that many of the difficulties or characteristics of primitive language persist in recognizable form in our present highly developed languages.

PSYCHO-PHYSIOLOGY OF COLOR

LIGHT rays which enter the eye stimulate the physiological processes of vision which result in the sensations of brightness and color. Thus it is seen that vision involves the physical stimuli, the physiological processes, and the psychological sensations. It is impossible to separate completely the physiological and psychological elements; hence this discussion is presented under the combined term, psycho-physiology. Visual experiences touch the whole personality and, therefore, the physiological and psychological results of color are more complex than is indicated by the foregoing simple description of the visual process. The effects of visual stimuli can be observed upon the blood pressure, upon muscular, mental, and nervous activity, upon the mood and in various other ways. There is a vast amount of data available upon the physiology and psychology of color-vision but relatively little concerning the effects of color sensations upon the human organism. The latter data are of chief interest to us from the viewpoint of the language of color, however, various color phenomena will be

discussed here because of the complex texture of the subject of this book.

Numerous hypotheses of color-vision have been proposed, some differing entirely in principle while others are closely related to each other. An extensive discussion of this aspect of color is not contemplated because space does not permit and because it would be out of place here. However, it appears profitable to discuss this subject by comparing the two hypotheses which have the greatest number of adherents and which have been studied and discussed extensively. In treating these two theories—for in many aspects they have evolved from the “hypothesis” stage—we are not especially concerned with the physiological processes involved but with the main characteristics which aid in clearing the view for a better understanding of the possibilities of the application of color.

Many years ago, Young constructed the three-color theory largely from the facts of color-mixture. It has already been noted that any color can be matched in hue and in brightness by a proper mixture of the three primary colors, namely, red, green, and blue. Young assumed three sets of nerves or processes to exist in the visual apparatus and all color-sensations to be

due to the integral result of the stimulation of these three primary sensations, namely, red, green, and blue. Later, the great work of Helmholtz supplied this three-color theory with a more extensive experimental foundation. Many data of interest from the viewpoints of the theory and practice of color have been supplied by such investigators in the field of vision but there are still many questions unanswered. One of the most vulnerable points of the three-color theory of vision has been the lack of anatomical evidence regarding the three hypothetical sets of nerves or physiological processes.

Hering, who has been the most conspicuous and arduous antagonist of the foregoing theory, constructed an hypothesis of color-vision based largely upon the simple psychological facts of the appearance of colors, especially of the spectrum. From the simplicity of the appearance of white and black, red and green, yellow and blue, he concluded that these represented the primary sensations whose integral effects in any case were responsible for a given color-sensation. It was necessary for him to assume the existence of three chemical processes each of which was responsible for two sensations paired in the preceding statement. The building-up of one of the substances was assumed to

be responsible for one of the sensations of a given pair and the breaking-down of the substance was responsible for the other sensation. Unfortunately here again anatomical evidence of the existence of the three assumed processes is lacking.

There is much in favor of the Hering theory especially to those who have an intimate acquaintance with the appearance of colors. If the spectrum is studied, red appears to be undiluted with any other color, that is, no suggestion of another color is associated with it. This is considered by a great many persons not to be true of orange or of any of the "transitional" spectral colors between red and yellow, however, the latter appears to many persons to be a simple color unmixed with any other color. In progressing from the yellow toward the short-wave end of the spectrum no simple colors appear until we reach a certain green which appears to be a color in which no other color is suggested. Continuing through the spectrum we meet with another color which is simple in appearance, namely blue. White and black are also considered simple colors and thus the six simple sensations appear to be red, yellow, green, blue, white and black. This argument has much in its favor as a basis upon which

to found an hypothesis of color-vision. One of the most encouraging features of the Hering theory is the possibility that it may separate the brightness and hue phenomena completely and thus simplify many of the unanswered questions concerning vision. In fairness it should be noted that some investigators claim all colors are simple in appearance.

The phenomena of contrast has been one of the most conspicuous battle-grounds of the adherents of these two chief theories. This point is of special interest to us owing to the great influence of contrast—both in hue and in brightness—upon the appearance of colors and therefore upon their appeal to us. It is difficult to pass on without discussing many of the interesting phenomena of vision which have been discovered and investigated by adherents to these theories and without presenting some of the main features of other hypotheses worthy of consideration. However, such discussions would lead far afield without adding much of value from the viewpoint of the language of color. Suffice it to state that Young and Helmholtz who builded their hypothesis largely upon a foundation consisting of the facts of color-mixture, might be criticized for not giving the psychological aspect more prominence. Hering

has injected into color-vision theory the very interesting elements of sensation with greater prominence than his predecessors. Both theories contain much to be commended and it will not be surprising if future investigation shows each to be partially correct.

We are not concerned here primarily so much with the physiological and psychological phenomena which actually play a part in color-vision as with the general physiological and psychological effects resulting from the influence of color. As already stated these latter data are not plentiful for these fields of the science of color have not been explored to any appreciable extent. Féré studied the effect of colored light upon muscular activity which effect was measured dynometrically. In ordinary light this muscular activity was found to be 23 units on an empirical scale. It increased to 24 units for blue light; to 28 for green light; to 30 for yellow light; and to 35 and 42 units, respectively, for orange and red light. Thus is seen more evidence of the stimulating effect of the "warmer" colors.

Pressey, who has studied the effects of red, green, yellow, blue and white light of equal intensities, found that, after subjecting a person to a given color for five minutes, he could de-

tect differences in the effects of the various colors upon tapping activity, memory, mental work, etc. He found subjects with pronounced intolerance for a particular color. The mental processes of one subject might take 20 per cent. more time under the influence of one color or the memory work of another might show marked improvement under a certain colored light. Tapping activity was more uniform with green light, slower with blue light and decidedly quicker under red light. [Arithmetical work was strongly improved under red light and in a less marked way by an increase in brightness.] Pressey's work is encouraging from the viewpoint of the possibility of obtaining experimental data regarding the physiological and psychological influences of colors, for he finds constant differences indicated by the averages of the results from many subjects. Furthermore, it is well to note a characteristic result of his investigations, which is of great importance in the language of color, namely, the independence of such objective results from the subjective feelings. In other words, the colored lights which are experienced as pleasant do not necessarily produce more favorable conditions for working efficiency than those which are felt as unpleasant. Although this complicates our

problem by limiting predictions or conclusions, it appears to indicate a very definite and powerful influence of color upon the human organism. It is only natural to expect that, other conditions being equal, many activities would be favored by a "pleasant" color and hindered by an "unpleasant" one. This being contrary to the foregoing results it follows that the power of colors is by no means feeble in their influences upon the physical and mental activities.

In judging the appeal or affective value of color it is well to bear in mind that there are many pitfalls. For example, a colored light is likely to be judged according to the appearances of the familiar objects which it illuminates, whereas an object of this color is not always judged in the same manner because its color is not illuminating other objects either agreeably or disagreeably. For example, let us illuminate an entire scene with green light. It now has the appearance of a monochrome which in itself might be pleasing but suppose a human face appeared under this green light. The face would appear ghastly and under many circumstances the green light would be condemned. Remove the object which provoked this judgment against the green light and the aversion to green would perhaps disappear. It would be an endless task

to cite examples which would exemplify all the conditions under which color is viewed and judged, therefore it is most practicable to make a plea for keen analyses of conditions before a judgment is reached.) The mental notes gleaned from the careful analyses should accompany any judgments of the effects of colors if progress is to be made.

It is quite helpful in any application of color to be acquainted with the chief phenomena of color and, therefore, a few of these will be described briefly. After a color has been viewed for some time and then is suddenly replaced by a neutral gray an outline of the original color is seen on the gray ground, but of a hue approximately complementary to the original. This phenomenon is called an after-image and is perhaps due to fatigue in the visual process. For example, if a bright green object be fixated for a few seconds and the eyes be then suddenly turned toward a neutral gray paper, a pink image of the object will be found to persist. This phenomenon would be explained on the basis of the three-color theory of color-vision by assuming that the "green" process, or set of "nerves," was fatigued so that on viewing the gray paper, which stimulated the three proc-

esses, red, green, and blue, the "green" process was incapable of responding as fully as the "red" and "blue" processes with the result that there was an excess of red and blue sensations over the green sensation. Consequently, the after-image appeared to be an unsaturated purple or pink in color. This phenomenon is quite apparent to the careful observer under many conditions encountered daily.

(It is well-known that the various colored sensations do not rise to their full value at equal rates nor do they decay at equal rates.) The facts that they do not rise to full value or decay to zero instantly and that their individual rates differ are of great interest in many cases. These effects are shown by swiftly moving colored objects. For example, this phenomenon can be demonstrated by placing a red square at the center of a larger blue-green square and moving this combination with a moderate motion at an arm's length under a fairly dim light, keeping the eyes fixated at a point near the middle of the path. The red square appears to shake like jelly because its image lags somewhat behind its proper place in the visual field. This phenomenon can be readily demonstrated by moving the image of a black and white pat-

tern over the retina at a certain speed. Fechner's disks strikingly demonstrate this interesting feature of color-vision.

Experiments have shown that the color-sensations overshoot their final values immediately after the presentation of the color stimuli. Blue overshoots the most, red next, and of these three, the green sensation is the most sluggish. This order also approximately represents the relative rapidity of the growth and decay of these color-sensations, blue being most rapid and green the slowest. The fact that colors can be mixed, as far as sensation is concerned, by rotating them on disks above a certain critical frequency is ample proof that color-sensations do not instantly rise to full value immediately upon the presentation of the stimuli and do not decay to zero at the instant that the stimuli are removed. The critical frequency at which the colors upon a rotating disk blend in the visual process varies with the hue, saturation, and brightness of the colors.)

Another interesting fact which is connected with the foregoing is that of adaptation of the visual process to color. In general all sensations of brightness tend toward a middle gray and those of color tend toward neutrality. For example, if one works under red light for some

time the saturation of the color seems to decrease and he becomes less conscious of the color. In a similar manner, colors of very high brightness appear to be less saturated than under a moderately low illumination. In accordance with this fact the artist paints a red object, illuminated by intense sunlight, orange or orange-red in color.

The greatest phenomenon which overshadows all others in importance in our everyday encounters with colors is that of contrast, for its omnipresence is responsible for most of our enjoyment of color. For the sake of analysis, it can be separated into hue and brightness contrasts. Little was known about the practical importance of these phenomena until the elaborate experiments and observations of Chevreul, the color expert of the famous Gobelins, nearly a century ago. Since that time these aspects of color have been given a great deal of attention by scientists and several laws have been established.

The contrast-effect is always in the direction of greatest opposition. For example, white and black, when juxtaposed, mutually influence each other so that the white appears brighter and the black appears darker. If red and green are juxtaposed, the red appears redder than

when viewed amid neutral surroundings of approximately the same brightness and similarly the green appears greener. If a gray patch is surrounded by a certain color, the smaller gray patch no longer appears uncolored but assumes a tint usually approximately complementary to the surrounding color. This is called an induced color. For example, if the surrounding color be green, the induced color of the central gray patch is pink. This induced color is most striking when the inducing color is highly saturated and when the gray is of a brightness about equal to that of the inducing color. This reduces the effect of brightness contrast to a minimum otherwise the brightness contrast may play a conspicuous part and, in some cases, may tend to veil the effect of induced color.

The contrast-effects are a function of the nearness of the different colors to each other; that is, the nearer together the greater is the contrast-effect. If the colors are juxtaposed without any dividing line of black or other color the mutual effect of the two colors is greatest.

Hue contrast is most evident when the saturations of the colors are greatest. It has been contended by some observers that the cold colors, namely, those near the blue end of the spectrum, produce stronger contrast-effects than

the warmer colors. The author is not convinced that this is true. It is difficult to assign a superiority to any particular part of the spectrum because of the great difficulty in controlling the different variables in actual experiment in order to reach definite conclusions. It would not be surprising to find the warmer colors more effective than blue in producing strong contrasts because, as a general rule among the colors ordinarily encountered, the reds and yellows are more saturated than the blues.

In this chapter the chief phenomena of color have been briefly discussed. These and many combinations of them are of extreme importance in the use and observation of color. It has been seen that there are many elements to be considered from the various viewpoints of physics, physiology, and psychology. The physical aspects are associated with the production of color; the other aspects are found in vision and in the accompanying effects of color upon the human organism. A visual impression is "the starting-point for a whole hierarchy of mental reactions" and its importance is further emphasized by Münsterberg who states that "each time our perceptions and apperceptions, our feelings and our attention, our imagination and our will are involved."

In attempting to analyze the effect or impression of color on the human organism, many factors must be considered. In fact, this is a problem for the trained psychologist. However, there is no reason why any person, with a moderate understanding of color and an ability to analyze, cannot add considerable to his own knowledge of the psychological effects of color if he exercises careful and analytical observation.

Space will not permit an extensive discussion of the psychological aspects involved, however, it appears essential to note two general positions which color occupies with respect to consciousness. In one case it occupies the focus of attention and in the other case it does not although it still is influential. For example, a color arrangement may be so closely studied and the thoughts be so given over to the consideration of color that the surroundings, especially if they are not unusual as to color, will be quite lacking in an appreciable influence upon the mind. However, in another case the environment may be of such a nature that one is pleasantly or unpleasantly conscious of it, especially if the object upon which the attention is focussed is not impelling enough to suppress the

influence of the environment. The so-called sub-conscious element must always be considered from the viewpoint of analysis, as a more or less dormant power capable at any time of injecting into the situation unexpected influences which modify the judgment. For example, the warm colors are predominantly stimulating but they may be either agreeable or disagreeable. The cold colors are predominantly restful but they may be either agreeable or disagreeable. Association, appropriateness, etc., determine their agreeableness, but these generally operate through the sub-consciousness.

Few persons are familiar with the meanings of various terms that must be used in analyzing and in discussing the psychological effects of color so that it may be profitable to present a few of these as defined by various psychologists.

Sensation. A sensation is a simple fact of consciousness which is referred to some definite sense-organ. Yerkes states, "There are three ways of classifying sensations or of arranging them. (1) According to their degree of psychological likeness. (2) According to the bodily organs (sense-organs) to which they are referred. (3) According to the kind of stimulus which gives rise to them." The first is the most

valuable for strictly psychological purposes because it takes account of the psychological peculiarities of the things to be classified.

Feeling. Feelings are usually classified into four varieties, namely, sense-feelings, emotions, sentiments, and volitions. The qualities given by various psychologists to the feelings are as follows:

WUNDT	ROYCE	TITCHENER
Agreeableness	Pleasantness	Pleasantness
Disagreeableness	Unpleasantness	Unpleasantness
Excitement	Restlessness	
Quiescence	Quiescence	
Tension		
Relaxation		

The following properties are given by various psychologists as common to all sensations.

ANGELL	BALDWIN	MÜNSTERBERG	TITCHENER	WUNDT
Quality	Quality	Quality	Quality	Quality
Intensity	Intensity	Intensity	Intensity	Intensity
.....	.....	Vividness	Clearness	.....
.....	Tone	Value	.....	.....
Duration	Duration	Duration	.....	.....
Extensity	.....	.....	.....	.....

Affection. An affection is a simple fact of consciousness which pervades the whole body. According to Yerkes "We sense and we feel.

The former variety of experiences yield us our thousands of qualities of sensation and the latter a multitude of simple facts which the psychologist calls affections.” A prominent difference between a sensation and an affection is that the former is associated with a sense-organ and the latter is referred to the body as a whole. Sight, pain, and taste are associated with the sense-organs but affections are not.] Feelings such as agreeableness, quiescence, and excitement exist as a condition of the whole body.

Emotion. Psychologists describe emotion as an affective complex. It is more complex than a sense-feeling. When the cognitive aspect dominates an experience is said to be an idea, or a perception but when the affective aspect is predominant the same general experience is called a feeling or an emotion. Emotions are associated with perceptions or memory experiences and might be considered strong-feelings. The different grades of emotions might be termed mood, weak emotion, strong emotion, and passion. Corresponding to these different grades respectively, we might experience wonder, surprise, astonishment, amazement; or another example might be kindness, friendliness, liking, love.

Sentiment. An emotion which is attached to

a particular object is called a sentiment. For example, a person may have a sentiment for his alma mater. Sentiments have been variously classified as ethical, esthetic, intellectual and religious although opinions may differ regarding this classification.

Volition. According to Wundt, an emotion together with its result is a volitional process. A person may be astonished and forthwith he thinks or acts. The combination constitutes a volition.

Association. This is perhaps fairly well understood but definitions will be incorporated because of the great importance of association in the effects of color. Dunlap says: "Association is the organization of experience by virtue of which the various kinds and part of content constitute a whole; it is the functional interconnection of the objects of experience as we find them; not a force or an activity. The statement of the principles or laws of association is by no means an explanation of anything, but simply a convenient summary of observed facts." According to Titchener: "The law of association is that all connections between sensations which are set up by the formation of perceptions and ideas tend to persist, even when the original connections are no longer fulfilled." Yerkes

says: "Association means that mental processes are related to one another instead of being isolated and relatively independent. They tend to run together without losing their identity; they become associated."

Concerning associations Thorndyke says: "The likelihood that any mental state or act will occur in response to any situation is in proportion to the frequency, recency, intensity, and resulting satisfaction of its connection with that situation or some part of it and with the total frame of mind in which the situation is felt."

Psychologists attempt to classify associations but it does not appear necessary here to devote the space required for such a discussion. By analyzing his own experiences the reader will be able to discern various types.

In presenting these definitions the author does not assume the burden of defending them because psychologists are not in complete agreement regarding many of these phases of their science. It is believed that the definitions are sufficiently clear and comprehensive for the present purpose. Surely if the use of these various terms be in accordance with the foregoing brief descriptions a long step will have been taken toward clearness of expression. It is with this hope that the material has been incorporated.

COLOR PREFERENCE

THE consideration of color preference must be divided into two parts, namely, the preference of colors influenced as little as possible by association, environment, and other factors, and the preference of colors as affected by the ordinary environments of everyday life. Data of the first kind are obtained from experiments with colors amid neutral and uninteresting surroundings upon subjects especially instructed to eliminate associations insofar as it is possible and to choose the colors for "color's sake" alone. Data of the other kind are obtained by merely observing the colors which are used under various conditions in decoration, in dress, etc., and at the same time obtaining other information which is obviously of consequence. Such data are difficult to analyze notwithstanding the ease with which they are obtained because of the many uncontrolled factors which are influential. However, it is a fact revealed by observation that the warmer tints and shades are used more generally than the colder ones for the decoration of large interior areas. It is

quite possible that this custom has arisen from the desire to counteract, to some degree, the coldness of daylight.

Most interiors are considered, unconsciously at least, to afford protection to us and doubtless the use of warmer tints is a natural sequence of the desire to make the interior cheerful. It is to be noted that, in the natural expression of refined taste, tints and shades are more favored than the purer colors. It is true that pure colors are used but only sparingly as compared with tints and shades. In a sense, the limited use of the purer colors can be justified by considering that their chief function is one of emphasis. Although not an invariable rule, it is certain that something of an individual's nature or degree of refinement can be interpreted by observing the colors with which he chooses to surround himself. Closely akin to this predominant use of warmer tints and shades in interiors is the widely prevalent idea that artificial illuminants in interiors, devoted largely to social purposes, must be of a warm yellowish tinge. Perhaps this habit is the result of a subconscious association of the light with the cheerfulness and protection afforded by the primeval campfire, but more likely it is merely the insistence of habit resulting from associating a warm

yellowish color with all the artificial illuminants of the past.

These facts and many others closely related must be considered, but from the viewpoint of the language of color, the preference of color for color's sake alone is of chief interest. Eventually, the view may be extended, but in the present rudimentary stage and with the aim of interpreting the language of color the discussion and experimentation must be confined chiefly to the effects of color alone as far as possible. In passing it may be observed that Nature employs a relatively small amount of pure color. Even the glorious sunsets are devoid of pure colors, all the beautiful effects arising from ever-changing combinations of tints and shades. Many of the beautiful scenes in Nature are painted chiefly with tints and shades, although here and there slight amounts of fairly pure color lend emphasis by contrast. In the fleeting and casual glance of most observers the beauty of Nature's color is unseen owing to this lack of great areas of pure color. It appears that most persons ordinarily do not observe color unless it is present in relatively large areas and of fairly high purity or unless the contrast is striking such as in the case of a yellow or red flower amid a large area of green foliage.

The results of investigations of color preference from the other viewpoint, namely that in which the influence of all other factors besides color itself is minimized, are relatively more definite owing to the relative simplicity of this aspect. That is, when the object is to obtain results that are definite and capable of being quite thoroughly analyzed, laboratory experiments upon a large number of observers suffice and these are readily controlled. Of course, there always remains the question as to how completely the influences of association, habit, environment, etc., have been eliminated, but the consistency of the results obtained by various careful investigators is a favorable indication that data obtained from such experiments are valuable. Definite data have been obtained for various aspects of the problems of color preference confronting us and the experiments are constantly being extended into the vast unknown of the psychology of color. Some of the results will be presented with brief discussions and interpretations. It is recognized that the latter may not always be tenable as new data are unearthed but the intention here is to complete the chain of evidence as it exists at present which points toward a language of color.

It has been quite conclusively established that

fairly pure colors are more highly preferred than colors of lower saturation and of lower luminosity; that is, admixture of white or black (in the case of pigments) lowers the preference of a color. In other words, pure colors, in general, rank higher in the preference order than tints and shades. The rank of tints relatively to shades in general has not been definitely ascertained. Bradford, in experimenting with twenty-six university students with a set of fifteen colored papers, found that saturated colors were most preferred and that the admixture of a small percentage of another color lowered the position of the color in the preference order. He also found that the preference order remained fairly constant for individuals by repeating the same experiments on three observers after the lapse of one year. Cohn, the author, and others have also arrived at the conclusion that, in general, pure colors are more highly preferred than tints and shades when other influences are minimized. It will be noted that this conclusion is apparently contradicted by the ordinary usage of color in daily life, but it must be remembered that in the latter case the conditions are complex. Although other data are available the foregoing points are well exemplified in the results of color preference

experiments on 115 male and 121 female college students, the data having been furnished to the author by Prof. Mabel C. Williams. These

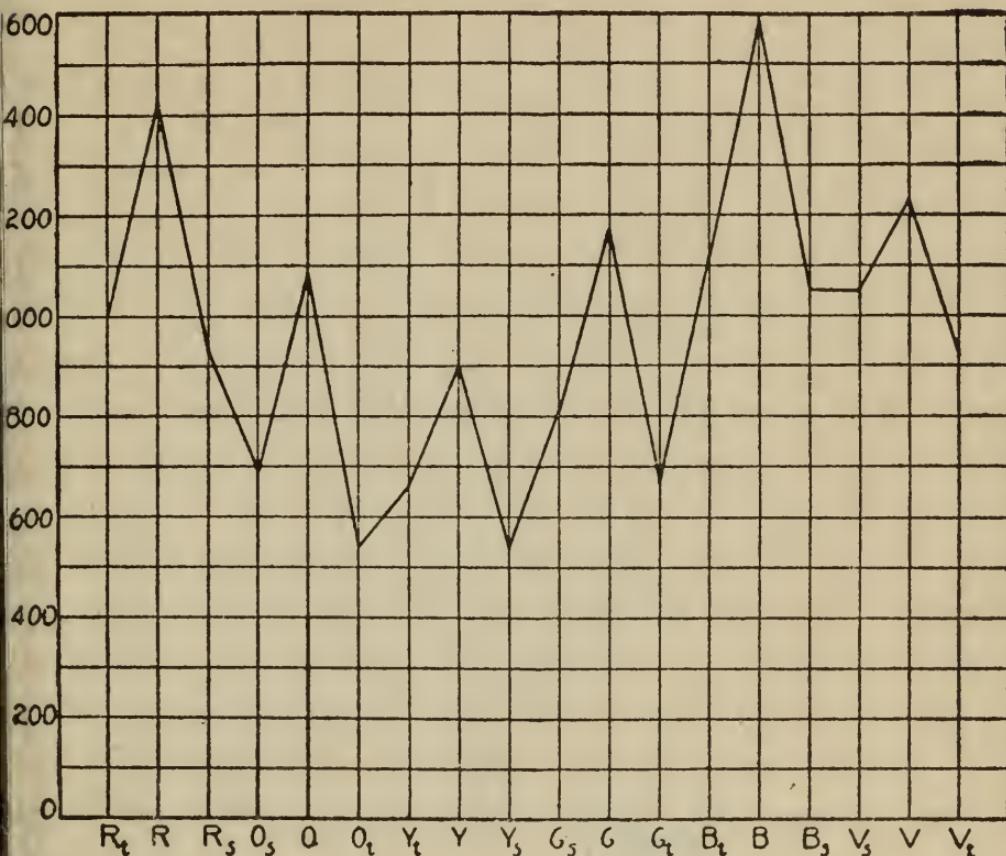


Fig. 1. Showing total number of times each color was preferred by 115 male students.

data were obtained by the method of paired comparisons. Colored papers were compared in pairs upon a neutral background, there being a total of 18 colored papers, comprising a tint, a shade, and a fairly pure color of 6 different

hues. By this method each of the 18 colors was compared with every other color, the observer recording his choice in the case of each pair.

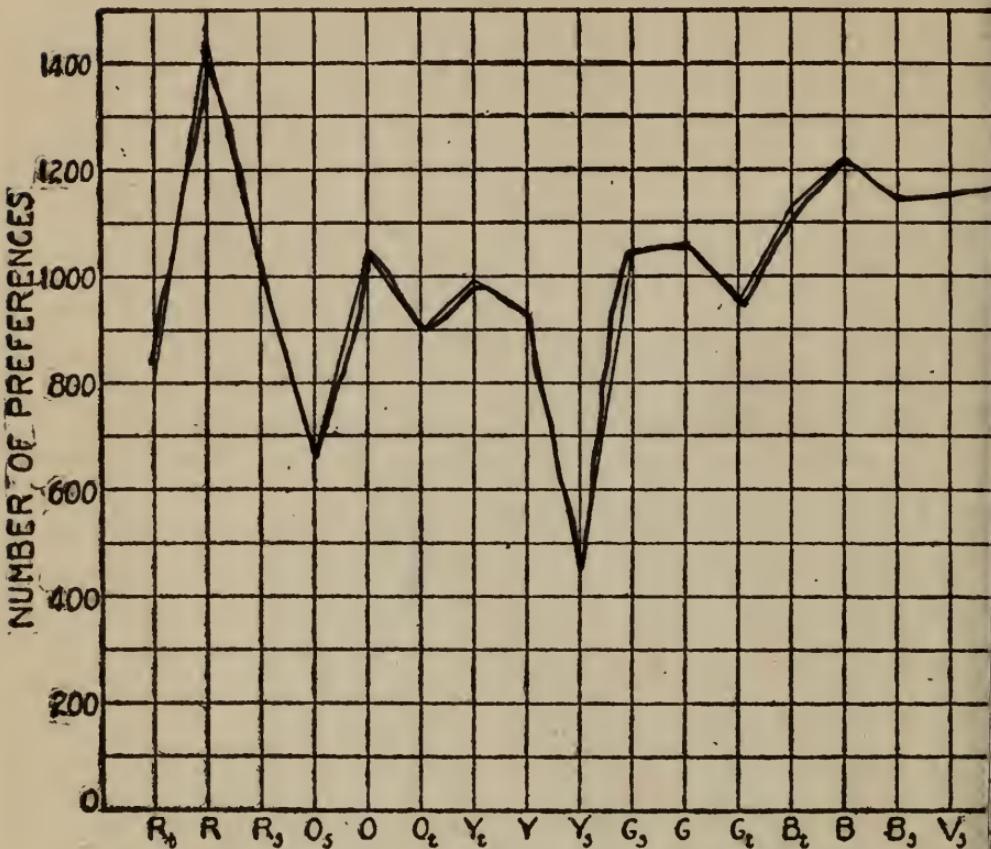


Fig. 2. Showing total number of times each color was preferred by 121 female students.

Each color therefore came under the subject's observation 17 times. A summary of the total first choices for the different colors indicate the relative rank of the various colors. The results were reduced by the author durin

which process a few uncertain cases were discarded. In Fig. 1 are plotted the total number of choices of each color by the 115 young

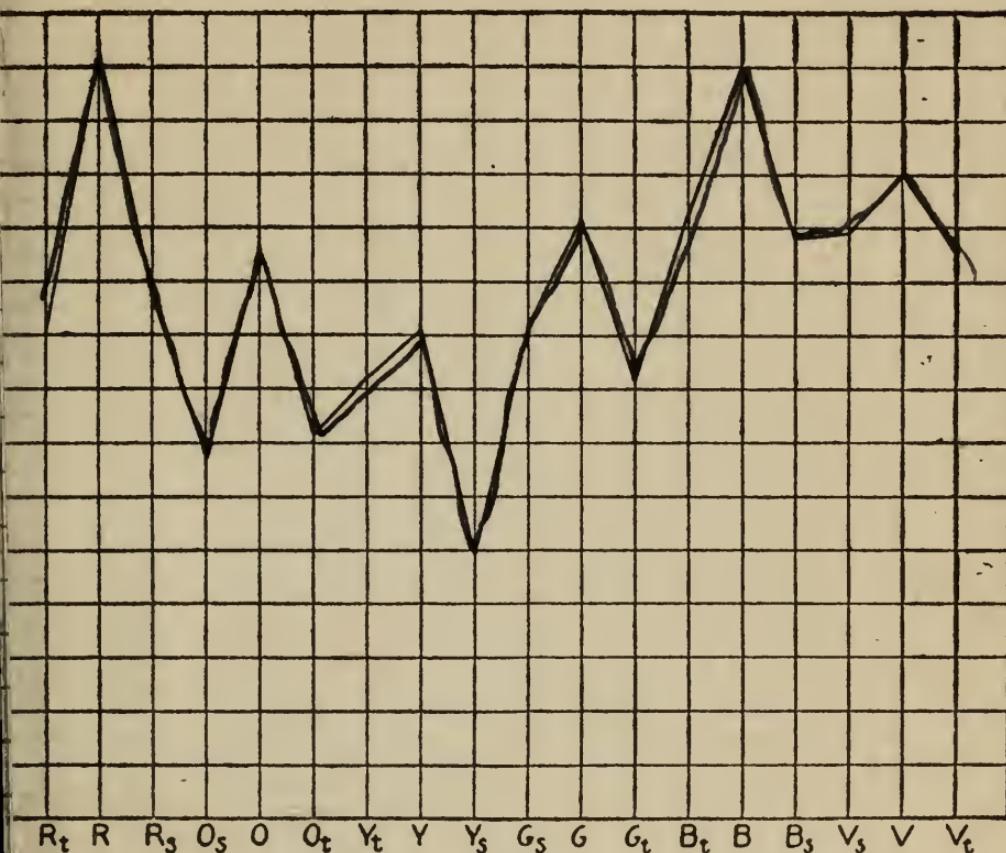


Fig. 3. Showing total number of times each color was preferred by 115 male and 121 female students.

men. Similar results are shown for the 121 young women in Fig. 2, and the total choices—for men and women—are shown in Fig. 3. It will be noted that in the case of the men the pure colors are very definitely preferred to the

shades and tints as indicated by the peaks. The pure colors (as pure as obtainable by means of pigments) are indicated on the horizontal scale by the initial letters, R, Y, etc.; the tints by a subscript *t* as R_t ; and the shades by the subscript *s*, as R_s . In the case of the young women, Fig. 2, the peaks are not so well defined; however, a similar conclusion is tenable. The yellow shade was the least preferred of all the colors. It will be noted that the tints of yellow and orange so commonly employed in interior decoration are among the least favored in experiments on color preference where the colors are chosen largely for color's sake alone.

An inspection of the three illustrations will reveal the results more clearly than further discussion; however, it is interesting to note the summary presented in the following table. There are many limitations to the application of mathematics to such problems; but it appears safe to summarize the total choices of tints, shades, and pure colors for the sake of drawing further conclusions of a general nature. The number of times that tints, shades and pure colors were chosen are given separately for the men and for the women. The total number of choices are also presented.

Summary of Choices Registered for Tints, Shades and Pure Colors

	CHOICES BY 115 MALES		CHOICES BY 121 FEMALES		CHOICES BY BOTH	
	Total	Average	Total	Average	Total	Average
Tints	4906	42.7	5977	49.3	10883	46.0
Shades	5064	44.0	5378	44.5	10442	44.3
Pure colors..	7399	64.2	6836	56.5	14235	60.4

A better comparison is obtained by computing the average number of choices per observer for each of the three kinds of colors. These are given in the remaining columns. For example, the average number of times tints were more preferred than the other colors, was for men, 42.7, for women, 49.3, and for both combined, 46, the latter being a simple mean. In each column of average choices the sum should equal 153 because there are 153 different combinations, of two each, obtainable with 18 colors. However, in no case is this true owing to the necessity of discarding a few choices owing to very obvious errors. It is seen that the tints were somewhat more preferred by the women than by the men, but the reverse is true for the purer colors. Shades were about equally preferred by the men and by the women. The summary of average choices in the last column show

clearly that the purer colors are most preferred and little difference exists between the tints and shades. This result is in accord with that of others as previously noted.

The foregoing represents only one of the many interesting problems of color preference. Another important question to be answered is the relative rank in the preference order of colors of equal purity as ordinarily determined. From a general experience with color and from observation of the general attitude of many persons toward colors, the author was led to the conclusion that, for fairly pure colors at least, the colors near the ends of the spectrum are generally more preferred for color's sake alone than those near the middle. Another viewpoint would be that the more luminous of the spectral colors are less preferred than those of lower reflection factors. Experiments of others indicated that this conclusion was tenable but no data were available which had been obtained with a large number of colors of approximately the same degree of saturation. Therefore a set of 15 fairly pure colored papers was used, among which were three colors of approximately the same saturation but which would be classed as shades, namely, a dull yellow-green, a dull green, and a slate blue-gray. Fifteen ob-

servers were used and they were instructed to choose the colors for "color's sake" alone. The colored papers, each 4 inches square, were

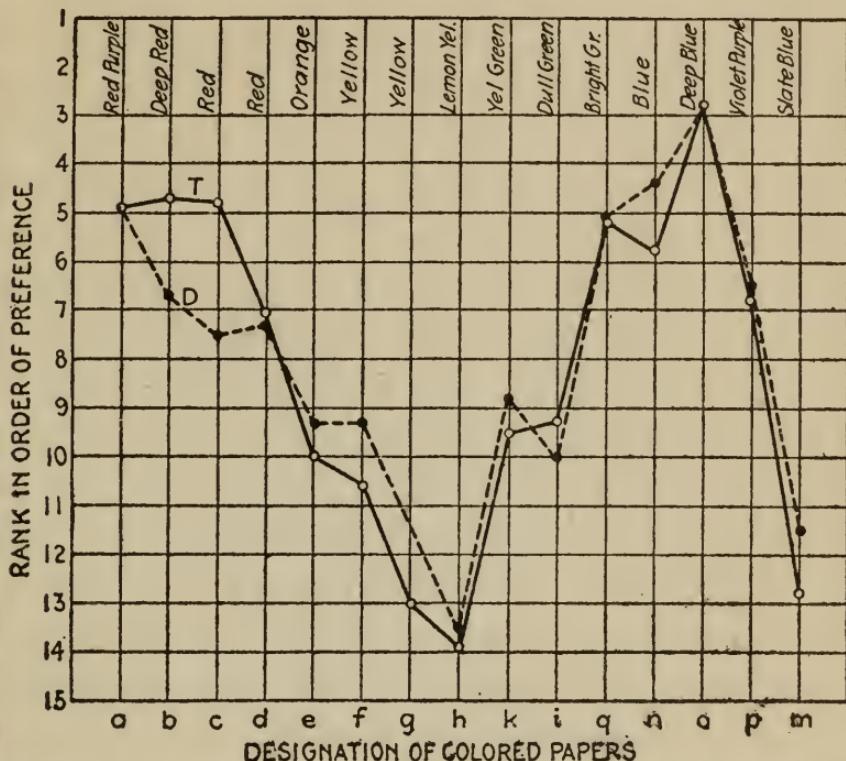


Fig. 4. Showing preference order of fairly saturated colors under daylight illumination, D.; under tungsten lamp illumination, T.

spread upon a white surface, each color being kept at some distance from the others. These were mixed haphazardly several times while the observer studied them for a few minutes. He then began to pick them out in the order of preference. The mean order of preference for

the 15 subjects is presented in curve D, Fig. 4, for daylight illumination and in curve T when the colored papers were illuminated by incandescent tungsten lamps. The two observations were made by a given subject at intervals not less than several days apart. It is seen that for these conditions the colors near the middle of the spectrum are less preferred than those at the extremes. A few experiments under the same conditions, except that the white background was replaced by black, indicated the same general results although slight differences no doubt would have been observed if sufficient data had been obtained. For pure colors, however, it appears that the results would be quite similar with various neutral backgrounds.

Inasmuch as the appearances of colors are very much influenced by the illuminant, the two different illuminants were used. It is not surprising, however, that, with fairly pure colors, the same general results were obtained in these two cases. By using a large number of observers and a greater number of colors it would be surprising if the results under the two illuminants did not differ considerably, especially with less saturated colors. Many interesting points remain to be investigated although a few general conclusions can be drawn from the data

at present available. It will be noted that the author's results described above are confirmed by the data presented in Figs. 1, 2 and 3.

Minor devised an experiment to test the relative preference for saturated over unsaturated colors using colored circles one meter in diameter. He used seven colored gelatine plates, from violet to red, in a projection lantern, thus projecting the large circle of colored light upon a white screen. He used three degrees of saturation but kept the brightness constant. The reactions were to be immediate without reflection or comparison and the judgments were to be expressed in the five following terms: very pleasing, pleasing, indifferent, displeasing, very displeasing. The subject was then questioned regarding associations, feelings, and judgment processes. Saturated colors were in each case found to be more preferred than unsaturated colors. As might be expected the judgment was found to be influenced by the pleasingness of the colors themselves, the bodily conditions, the mental state, and by associations.

Somewhat contradictory to these results, Washburn and her students found on comparing colored papers 5 cm. square with others 25 cm. square that saturated colors were preferred in the smaller area, except saturated red. In

the larger area, tints and shades were preferred. It is dangerous to draw many conclusions without a greater amount of data, but it appears plausible that the saturated colors were only preferred in the smaller area when it is considered that such is the most common usage of saturated colors by Nature and by mankind. If our tastes have been molded by Nature or are indicated by our artificial environment it is not surprising that even in a laboratory experiment the purer colors would be preferred in the smaller area and the tints and shades in much larger areas. It is well to note that the absolute dimensions are of little moment as compared with the solid angle subtended by the colored object. The latter is determined by the distance from the eye to the object as well as the absolute size of the object in ordinary vision. According to Washburn and Crawford, when colors are fixated for one minute the arousal of associations and adaptations may change the affective value. They claim that associations have little influence on saturated colors and what they have is favorable. It appeared from their results that adaptation was favorable to violet, blue and green, unfavorable to yellow and red, and on the whole unfavorable to tints and shades.

Associations were favorable to tints and to shades of violet, green, orange and red.

Jastrow, at the World's Fair in 1893, tested 4500 men and women for color preference and found blue to be preëminently the favorite color for men and red for women. This is confirmed in Figs. 1 and 2. Starch tested 133 persons—69 men and 64 women—using ten Hering colors on a white ground including approximations to nine spectral colors and a purple. The results indicated that the colors near the ends of the spectrum in general were most preferred. Red and blue ranked highest for both men and women although blue was slightly more preferred by the men and red more preferred by the women.

Wissler tested the color preference of about 300 men and women with similar results, that is, blue ranked first for men with red next. Red was the favorite for the women. The colors near the middle of the spectrum ranked considerably lower in the preference order than the colors near the extremes of the spectrum. Yellow ranked lower than all other colors including white although the latter was next to yellow in the preference order. Orange was third from the bottom and green next above it. Thus it

is seen that insofar as the various investigations have proceeded fairly consistent and therefore reasonably conclusive results have been obtained in most cases. Unfortunately pure spectral colors have not been used in such experiments.

This, in brief, is the status of our knowledge of color preference as it exists at present. Many other data could be presented and discussed, but for the sake of brevity many of the contributions of other investigators have been omitted although they have been influential in the discussion already presented. Discussions of various aspects of the influence of color are presented in other chapters.

AFFECTIVE VALUE OF COLORS

IT is possible for every visual impression to be a cause of a mental reaction although it is obvious that the effectiveness of visual stimuli in this respect is largely dependent upon the state of intellectual development of the individual. It seems likely to depend upon the ability of the individual to observe and to react. In dealing with the present subject it is of direct interest only to consider the affective value of colors upon normal individuals of at least average mental ability and intellectual development. In many of the previous chapters various subjects have been treated for the purpose of obtaining a view of the various factors which have been influential in molding our present attitude toward colors. It has been seen that the psychology of color is indeed complicated not only by the past experiences of the individual but also by the superstitions, habits, and experiences of a long line of ancestors extending far back into the early childhood of the human race. However, after presenting brief discussions of many of these factors it appears of interest to discuss the results obtained with normal intellectual

subjects upon the affective values of colors. Unfortunately the knowledge of the psychology of the affective processes is in a very unsatisfactory and unsettled state. The physics of color is well established, but this is not true of the physiology and of the psychology of color. There is a vast amount of data available which bears upon the physiological aspects of color, but many of the experimental results are as yet unreconcilable with each other or with any general theory of color-vision. The psychology of color is even in a more chaotic state, and owing to the meagerness of the data bearing upon this aspect it is almost an unexplored unknown. However, there are data available which are of extreme interest from the viewpoint of the language of color.

It is to be expected that there will be very conspicuous differences among individuals because each has acquired so many and so varied emotional and sentimental attitudes toward colors. Individual experience and temperament are very important factors which are responsible for variations among individuals, however, a general consistency is usually perceptible in psychological experiments with colors provided sufficiently large groups of subjects are used. Many difficulties arise when the attempt is made

to interpret the experimental results upon the affective values of colors because the affective processes are so little understood and the experimental methods are not wholly satisfactory. However, these difficulties will not be considered in presenting data which will be of interest here.

[The variety of brightness and color sensations which is experienced by the individual depends upon the state of his visual development. He observes what his previous experience has prepared him to observe. Psychologists state that the affective value of a visual sensation is the result of the affective tone of the sensation, of the affective elements of consciousness, and of the sentiments and emotions which are associated with the visual experience.] For instance, a certain color may be pleasing because it has an agreeable affective tone but another color may be pleasing because it is accompanied by a pleasant emotion although its affective tone might not be pleasing]

(It would be advantageous in such studies to separate the effects of hue from those of luminosity or brightness, but this is in general very difficult.) From a series of neutral grays extending from white to black an individual will usually choose certain grays that are agreeable to him. These are usually near the middle of

the series. In other words, neither white nor black would be chosen as the most agreeable generally. (It should be borne in mind that the brightnesses are chosen as most agreeable not for their absolute values but for their values relative to those associated with them. It is also certain that colors are accompanied to a greater extent than grays by sentiments, emotions, and affective elements of consciousness.

The purer colors are, in general, more agreeable than the slightly saturated colors, although it is contended by some that green and violet reach their highest degree of agreeableness when not of greatest purity.) These conclusions of course are drawn from experiments in which the effects of environment and other external factors are simplified and minimized as far as possible. The discussion of color preference in another chapter is of interest here.

The data available are in quite complete agreement that the so-called warm colors, red, orange and yellow, are stimulating or exciting in varying degree from a maximum for red (scarlet) to a less degree for the yellow. Green is fairly neutral in this respect, blue produces a grave mood-reaction and violet a similar one which might be described as solemn. Considering the colors in the spectrum it is seen that

there is a definite variation from red to violet and it is generally agreed that both extremes of the spectrum and combinations of these—the purples—produce fairly neutral or tranquil mood-affections. This is quite in agreement with general experience.

It is certain that different colors stimulate various mood-affections especially powerfully in those who possess fine sensibilities. It is of interest to note the description of the affective values given to various colors and as an example the following analysis by N. A. Wells of the effects of color upon himself is presented:

Crimson, or deep red with a trace of blue in it, when standing alone, or seen in large quantity always gave him vague impressions of passion, rage, blood, etc.

Scarlet, or red with a trace of yellow—the blare of trumpets.

Deep orange, the heat of flame; soon excites irritation to a feeling of suffocation.

Orange-yellow, warm, glowing, lively.

Yellow, joyous, gay, merry.

Yellow-green, cheerful, smiling.

Green, peaceful, neither sad nor cheerful.

Blue-green, sedate, sober.

Blue, cool tranquillity.

Violet-blue, stern, hard, unyielding, gloom.

Violet, subduing, serious to the point of melancholy.

Purple, stately, pompous, impressive.

It is certain that few persons would exactly agree in analyzing their mood-reactions to a similar series of colors but there are indications that an approximate agreement would be found quite general. It is interesting to note the influence of association with certain colors and to conjecture upon this influence with other colors in the foregoing list.

A number of investigators have studied the affective value of colors with large groups of subjects and certain general facts have been established. It appears to be most profitable to present the procedure and results of a number of investigations because a broader view will be thus obtained.

Wells has experimented with large groups of subjects consisting of both men and women. He used the twelve colors whose mood-reactions upon himself have already been presented. The colors were painted with aniline dyes to as full saturation as possible upon white water-color paper. Two-inch squares of these colors were mounted about three inches apart in a horizontal row upon a large neutral gray background. The latter is preferable to white or black be-

cause it avoids extreme brightness contrasts. Furthermore, such colors are usually of greatest power amid such an environment. The colors were arranged in their spectral order, thus minimizing the effects of simultaneous contrast. The color-chart was hung before the group of subjects and the following list of words was displayed upon a blackboard:

quiet	exciting	depressing	peaceful
sad	solemn	loud	dignified
lively	neutral	heavy	gloomy
somber	gay	light or airy	energetic
restful	cheerful	noisy	dainty

The subjects were requested to write one of these adjectives (or any other if they so desired) which expressed the feeling or mood suggested by each color. All were cautioned not to employ purely subjective descriptions, such as pleasant, unpleasant, agreeable or unagreeable, because it was not so much a question *what* they liked or disliked as *why* they liked or disliked.

It will be noted that the adjectives in the foregoing list can be classed into three groups of energized, tranquilized, and subdued moods. The replies are classified under these three groups in the following table in which a summary of the results with 63 subjects—32 men and 31 women—are presented.

Total Number of Replies from 63 Subjects Indicating Three General Types of Mood-Reactions Due to the Twelve Different Colors

	Exciting influence	Tranquilizing influence	Subduing influence
Crimson	41 59	0	10 2
Scarlet	56 79	0	0 1
Deep Orange	59 79	0 3	0 1
Orange-yellow	55 73	6 12	0
Yellow	53 70	6 12	0
Yellow-green	14 18	39 52	5 12
Green	28	32	0
Blue-green	32 33	23 38	6 1
Blue	11 18	21 35	30 30
Violet-blue	0 4	17 19	45 6
Violet	0 1	6 8	54 7
Purple	3 4	1 4	48 6

The subjects were college students scattered through the various colleges of engineering science, literature and arts, and agriculture.

The results indicated no great sex difference excepting in the blue-green, but seemed to indicate that the development of color perception is more complete among women than among men. (The hues in which red predominates induce a mood-reaction of an exciting character. This excitation began to appear for a few of the subjects with the purple, increased in strength for crimson, became a maximum in the scarlet and deep-orange, thence diminished until the mood-reaction became one of tranquillity for the

yellow-green. From this point there is a curious rise toward excitement which becomes pronounced in the blue-green and gradually diminishes in passing through the blue and violet-blue. It is interesting to note the contradictory nature of the replies for the ~~middle~~ or tranquil region of the series of colors. It seems that these contradictions furnish evidence that the colors in this region are not of sufficient affective energy to induce reactions of a definite character in a large majority of sensibilities.

Wells believed that the combined stimulus of all those colors which appeared to be respectively exciting, tranquilizing, or repressing in affective character, would become cumulative if simultaneously presented. He therefore cut the color-chart vertically into three portions; the first portion containing crimson, scarlet, deep-orange, orange, orange-yellow and yellow; the second portion, yellow-green, green, blue-green and blue; and the third portion, blue-violet, violet and purple. These portions were placed on a blackboard ten feet apart so that when the eye rested upon one group the others were well outside the direct visual field. The same list of words was written upon the blackboard with the following list of qualifying adverbs in anticipation of more powerful mood-reactions which

might result from each group. The subjects were permitted to use any other qualifying words in describing the mood induced by each group. The additional words were:

richly	sadly	tranquilly	daintily
sedately	gayly	impressively	cheerfully
pompously	quietly	gorgeously	depressingly

The results firmly supported the conclusions arrived at in the preceding investigation.

It appears from this study "that a given sensory stimulus has, for normal sense-perceptions and under ordinary conditions, an affective character which remains constant regardless of any subjective attitude of the sensibilities toward that stimulus." For example, the responses to scarlet were gay, noisy, exciting, loud, energetic, etc. All of these indicate that the affective character of scarlet is exciting regardless of the subjective attitude toward it.

Powelson and Washburn studied the effect of verbal suggestion on the affective values of colors with 35 young women for subjects. The ninety Bradley colors were used, each color being 2.9 cm. square. These were shown one at a time upon a white background to each subject who was instructed to record a degree of pleas-

antness or unpleasantness using numbers from one to seven. "Very pleasant" was designated by number one, "indifferent" by 4, and very "unpleasant" by 7. The colors from the 36th to the 54th in the series (the middle eighteen) were presented with an accompanying verbal suggestion as to their affective value. The experiment was performed twice on each subject several days apart. During the first experiment the verbal suggestions accompanying the middle 18 colors were suggestions of unpleasantness for the first half of the observers and during the second sitting they were suggestions of pleasantness for these observers. The other subjects were treated reversely. The suggestions were of the form of favorable or unfavorable; for example, the words "faded" or "delicate" might be used in the two cases for a given color.

Twenty-five subjects gave results indicating a positive effect of suggestion in altering the judgments of affective value and the remaining ten subjects gave indications of a negative influence of verbal suggestion, that is, the judgments of the latter were altered in a direction opposite to the suggestion. From this it may be concluded that direct verbal suggestion regarding the pleasantness or unpleasantness of

a color has a fairly decided positive effect on the judgments of observers of this type and under the conditions of the experiment.

Robbins, Smith and Washburn, using the same series of ninety colors, studied the influence of fatigue on the affective sensitiveness to colors. The series was divided into four groups, A, B, C and D, the colors being selected at random for each group, but the colors of each group were always presented to the observer in the same order. Each color was laid on a white ground before the subject and she was asked to judge its pleasantness or unpleasantness, using the numbers from 1 to 7 in expressing the degree. The entire set of 90 colors was presented twice over at each sitting, the order of the sets being altered systematically. The order of the sets for the first sitting were ABCDBCDA, for the second sitting, BCDACDAB, and so on. It is thus seen that the element of fatigue would enter into two presentations of the series of 90 colors at each sitting because the first group was also the last in the order of presentation.

Without entering into the details of the investigation the general results will be presented. Eighty-two young women were used as subjects. Only 31 per cent. stated that they were bored at the end of the long series of 180 judgments.

Five of the 82 stated that they were more interested at the end than at the beginning. About 35 per cent. of those who reported being bored showed higher affective values toward the end than for the same colors at the beginning and 65 per cent. showed lower values. Thus a difference of 30 per cent. represented the tendency of the affective values to diminish as the result of ennui. Of those who reported equal interest throughout the experiment 36 per cent. gave an average affective value higher at the end than at the first presentation and 56 per cent. a lower value. The difference of 20 per cent. indicates the observers who, notwithstanding their failure to recognize ennui, showed a decrease in the average degree of pleasantness assigned to the colors at the end of the series. Other interesting analyses may be applied to the results but in general they indicate that, under the conditions of the investigation, affective sensibility to colors tends to diminish with ennui produced by a long series of judgments on the affective values of colors and that the decrease in affective sensibility is more closely correlated with the introspective reports of ennui than is the average affective value of the colors.

Washburn and Crawford have concluded that

when colors are gazed upon steadily for one minute the arousal of associations and adaptation may change the affective value. Their results indicated that associations have little influence in altering the degree of pleasantness of saturated colors and what they have seems to be favorable. Adaptation is favorable to violet, blue and green; unfavorable to yellow and red. Associations appeared to be favorable to tints and to shades of violet, green, orange, and red. Adaptation was on the whole unfavorable to tints and shades.

Geiger, using simple colors, concluded that the cheerfulness of a color was uniformly experienced as a quality of the color and not as a feeling of the subject.

Bullough investigated the problem of color appreciation and divided it into two parts: (a), the "aspects of color," that is, their objective qualities; (b), the "perceptive types," that is, the classification of observers on the basis of the character of the aspects which influence them when viewing colors. He classified the "aspects of color" into four groups, as follows:

(1) Objective aspect. The remarks of the subjects refer to the peculiarities of a color such as saturation, delicacy, brightness, muddiness.

(2) Physiological aspect. This is indicated by certain effects on the subjects.

(3) Associative aspect. This represents the suggestive power of a color.

(4) Character aspect. This includes the expression by a color of that which, in the case of a human being would be considered his character, mood, or temperament. This group represents by far the most complex aspect of color appreciation.

The "perceptive types" correspond to the main groups of color aspects and therefore the four terms noted above are also used for these. Bullough distinguishes between the "agreeable" and the "beautiful." When a color is agreeable we occupy the center but when it is beautiful the *color* occupies the focus of attention. In this plan of distinction the physiological type appears to be the type of lowest esthetic value. To subjects of this type colors are merely agreeable. The objective type occupy a position higher in the scale of esthetic values because of the greater importance of the color impression of these cases. Next above this type is that of "fused association" and the character type occupies the highest point in the scale of esthetic values. The freedom of this type "from purely

personal factors, from accidental memories and irrational associations, and its essentially emotional tone invest this type with a kind of objective reality which is generally characteristic of esthetic experiences, and stamps this form of color appreciation as the esthetic appreciation par excellence.³] It appears that the greatest understanding and widest application of a language of color eventually must depend upon the development of this highest type.

ATTENTION VALUE OF COLORS

QUIET another aspect of color is found on turning to the attention value. A color may attract attention whether it is pleasing or not and the power of attraction doubtless is, to some extent, proportional to the degree of pleasantness or unpleasantness. Of course, such factors as novelty, unexpectedness, contrast, congruity and others enter into the attention value of colors. Much of the data and discussions presented throughout this treatise must be correlated and weighed before conclusions can be reached regarding the attention value of colors because experimental data are very meager.

Unusual or incongruous uses of colors doubtless attract the attention of more persons than any innate characteristics of colors. For instance, a red hat worn by a man would attract attention because of the novelty and incongruity of the use of this color in such a case. This accounts for many of the uses of colors on the stage, in advertising, etc. Contrast both in hue and in brightness plays a very important part in the power of colors in attracting attention.

Few persons are conscious of colors if they do not occupy extensive areas or if the contrast is not very striking. A bright red or yellow flower amid dark green foliage will attract the attention of persons who ordinarily would not notice these colors if the great contrast were absent unless the colors occupied a fairly large portion of the visual field.

Hue contrast is a very important factor in the attention value and pleasing effect of colors. If a group of colors be illuminated by an illuminant whose spectrum extends over a narrow range of wave-lengths the beauty of the colors disappears. Under such conditions the colors are of approximately the same hue but differ in brightness. Experiments such as this impress upon one the conclusion that colors which are approximately complementary are likely to be the more striking combinations of colors. Doubtless there is an optimum relation between the brightness contrast and the hue contrast which renders a combination of two colors the most striking. This relation is perhaps different for various colors.

It appears that the reader may be able to draw his own conclusions regarding the attention value of colors after correlating the data presented in other chapters, however, a glimpse

f the data which are available may aid in guiding him in his analysis. Therefore examples of the experimental data which have been obtained specially from this viewpoint will be presented.

Gale, by using a method of rapid exposure in presenting various colors to his subjects, believed that he thus separated the attention value from the artistic value. In other words, he believed that attention value is determined by a very short exposure, whereas artistic value can be determined only by a sufficiently long exposure during which the subject can form a judgment. This appears reasonable and at least the artistic factor is reduced to a minimum and the attention value is doubtless fairly well determined. He exposed the colors for an instant upon a white background. In the following table is shown the number of times, N, each color was noticed and also the percentage of the times each color was noticed of the total number of times all colors were noticed. The subjects consisted of nine men and seven women.

It is seen that, for the whole group of observers, the attention value of red is the highest with black a close second and yellow the lowest. The degrees of purity and the relative brightnesses of the colors are not available but it appears safe to conclude that brightness con-

Attention Value of Colors

Color	Men		Women		Average
	N	%	N	%	%
Black	151	33.5	43	12.2	22.9
Red	88	19.5	113	32.2	25.9
Orange	88	19.5	38	10.8	15.2
Yellow	4	0.8	23	6.5	3.7
Green	87	19.3	66	18.8	19.1
Blue	24	5.3	38	10.8	8.1
Purple	8	1.7	29	8.2	5.0

trast is an important factor in attention value. Both red and black are very low in luminosity as compared with the white background and therefore the brightness contrasts in these two cases were very great. On the other hand, yellow is of high luminosity and the contrast in this case between the color and the white ground would be much less than in the cases of black and red. However, it is hardly possible that brightness alone accounts for the results. It is a matter of every-day experience that among the common colors red always attracts attention quite markedly.

In the field of advertising the attention value of colors is important and therefore this field would yield interesting data if records were available. Starch has presented a tabulation of colored advertisements appearing in various

magazines which showed that 77 per cent. used red; 19 per cent. brown; 8 per cent. blue; 6 per cent. orange; 6 per cent. green; 6 per cent. yellow; and 5 per cent. purple. These data show by the predominant use of red that at least advertising men regard it of high attention value. It appears from ordinary observation that red is quite predominantly used in colored displays. The use of red as a universal signal for danger appears to be another wholesale admission of its attention value.

Other factors enter into the acceptability of colors for attracting attention. Many colored advertisements are to be viewed under ordinary artificial illuminants which are rich in red and orange rays and poverty-stricken in blue and violet. Thus red does not suffer under artificial light but appears more brilliant and rich in hue than many other colors. On the other hand, blues and violets are robbed of much of their color and appear black, or nearly so, while yellow is very much washed out owing to the fact that the dominant hue of most artificial illuminants is yellow.

Starch has presented data which were obtained for the purpose of showing the power of color contrast. A white card containing 25 words was exposed before a group of per-

sons for a brief interval. Twenty words were printed in black and the remaining five in red were scattered among the rest. Immediately after the exposure each person recorded the words that he had retained in his memory. The following data were obtained with 24 subjects.

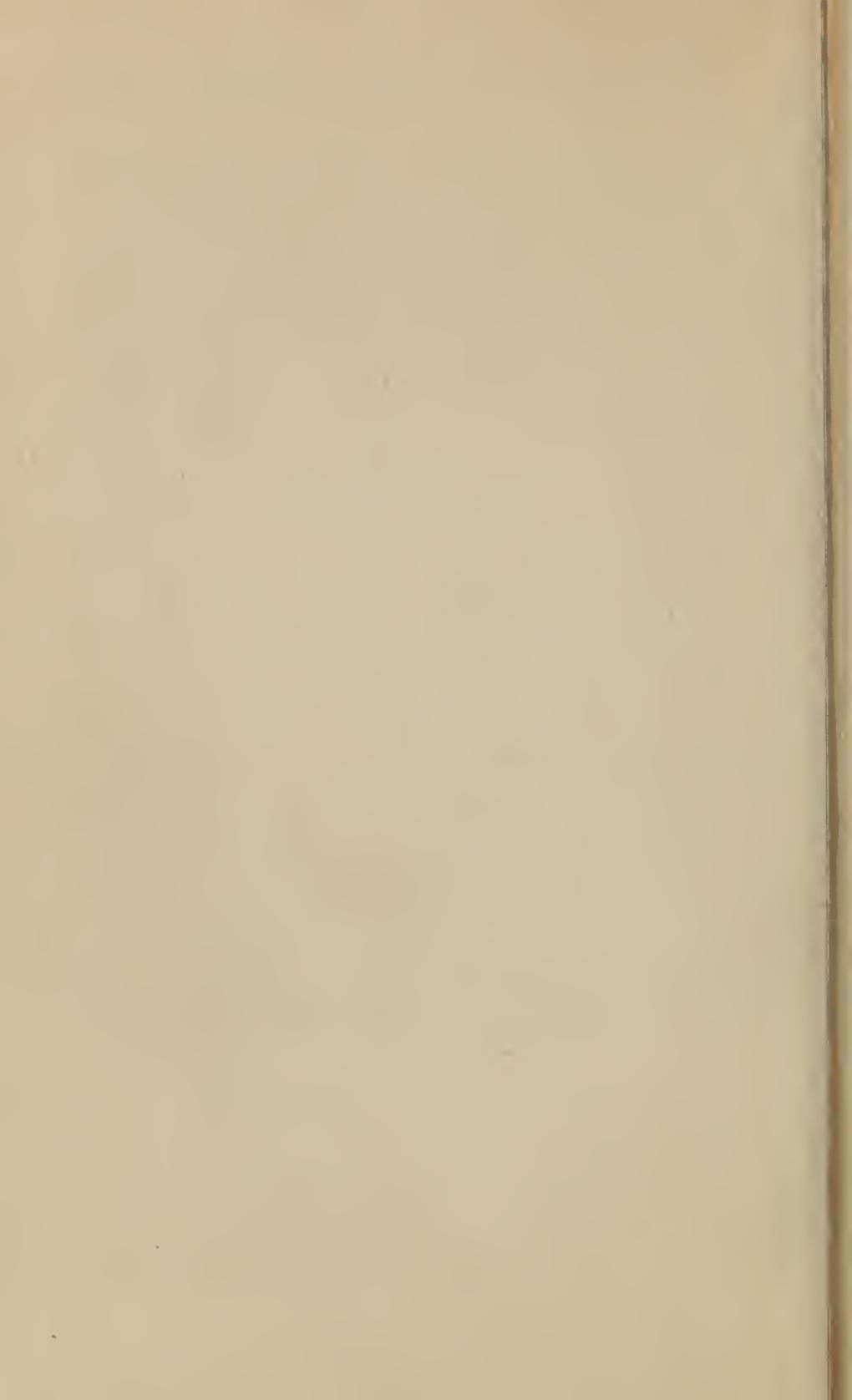
	Black	Red
Number of words exposed	20	5
Total noticed by 24 persons	39	78
Average number noticed per person..	1.6	3.
Percentage noticed per person	8.2	64

It is seen that the novelty or conspicuousness of the red words intermingled with the ordinary black words draws the attention predominantly to the red ones.

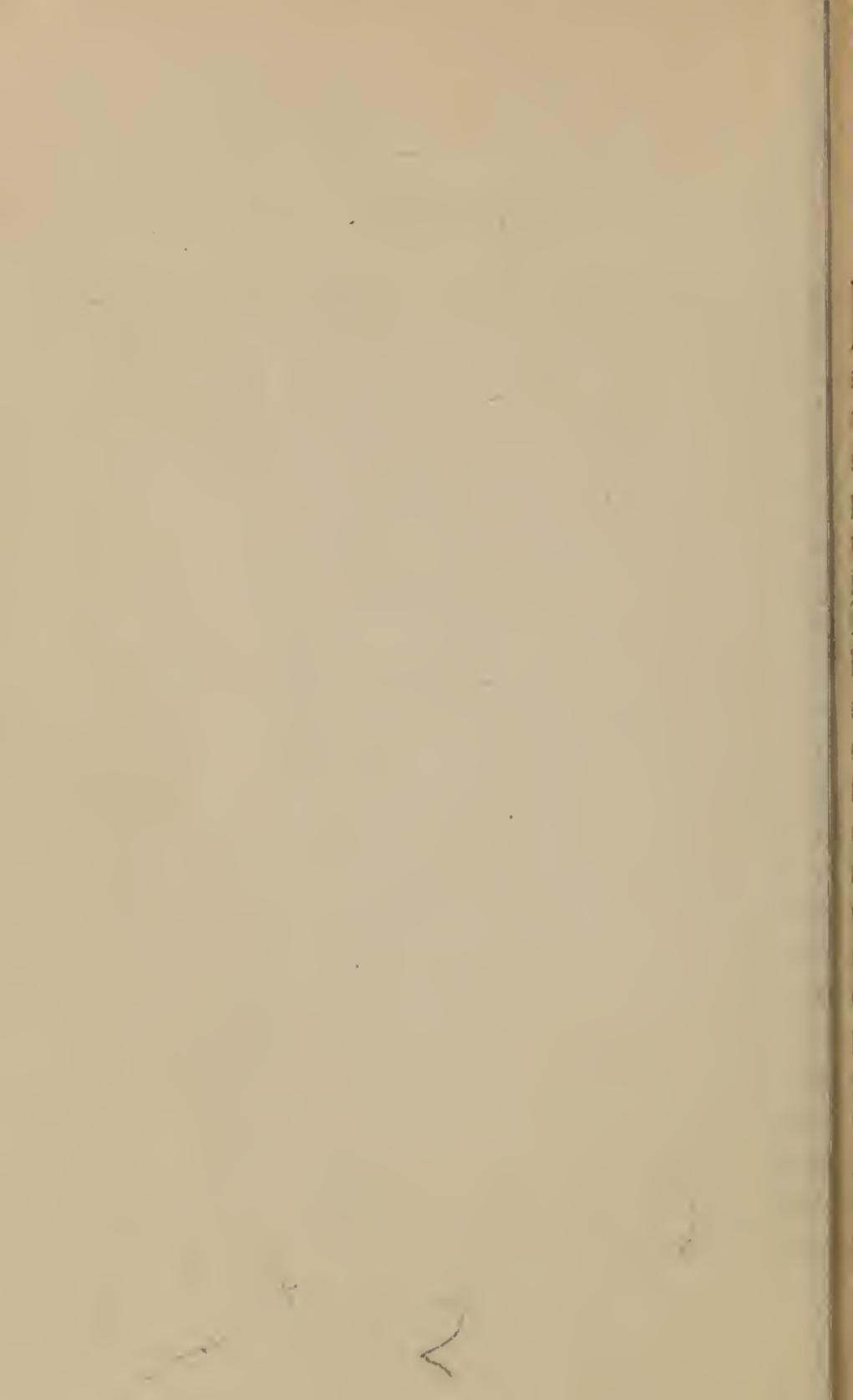
Many mistakes are made in the employment of colored inks for the purpose of attracting the attention to important words or statements apparently owing to a lack of knowledge of simple facts of color science. For example, in an advertising pamphlet the text was printed predominantly with black ink upon a yellowish tinted paper. Here and there statements to be emphasized were printed with an orange ink. Under ordinary artificial illumination those statements printed with orange ink were largely obliterated owing to the yellowish hue of the illuminant, with the result that a bad choice of

ink defeated the intended purpose quite completely. Thus it is seen that even after the attention values of various colors have been determined other factors also must be considered or difficulties are likely to be encountered.

It may be of interest here to note briefly certain results on the legibility of various combinations of colored printing reported in *Le Courrier du Livre*. It appears that the best combination for reading at a considerable distance was black type on a yellow ground. The familiar black on white combination ranked sixth with the following combinations intervening in their order of legibility: green on white, red on white, blue on white, and white on blue. There is some indication that considerable contrast in brightness is desirable but perhaps not extreme contrasts. Of course, various other factors, which cannot be discussed here, enter into the problem of legibility at a distance. This question is beyond the scope of this treatise but this brief comment has appeared of interest.)



PART IV



ESTHETICS

If the language of color ever becomes definite enough and the understanding of it becomes sufficiently universal to encourage its application as an independent means of expression instead of as an accompaniment to more interpretable languages as it is used at present, it will not be used alone to express the beautiful but also the disagreeable and the unpleasant. At the present time color is used chiefly to beautify and by its harmonies to appeal to the esthetic instinct. It is true that it is not always employed as a drapery for enriching or beautifying visual impressions, however, our chief acquaintance with color is through its use in the arts, both pure and applied. For this reason, we are inclined to relate color and beauty and most of our knowledge of the expressiveness of color gained from this source is, therefore, prejudiced by this natural association; hence in prolonging this discussion of the language of color into the realm of art we must expect to gain whatever information is available from the esthetics and harmony of color. It is well that such is the case and we should hope that the aim

of mankind in artistic creation will continue to be the introduction of the beautiful or idealistic into our environment.

To obtain a proper perspective it is necessary to understand what is meant by such terms as art, beauty and esthetic pleasure but in order not to digress too far from the object of this brief treatise only general definitions will be presented. Thus sufficient flexibility will be provided for the reader to introduce his own ideas regarding these matters which involve so much of that which we call taste. Owing to the fact that each individual differs from all other individuals because of the differences in the chains of experiences which make individuals what they are, the matter of taste is variable and indeterminate. Doubtless all persons possess esthetic instinct to a slight degree at least, and there are certain general guiding principles of esthetics which all would agree were correct, but when the element of taste is introduced into a problem the latter becomes indeterminate, for no solution can satisfy every individual. If inflexible definitions of art, esthetics, etc., were given, or if they were qualified by discussions, necessarily very extensive, we would find ourselves in a situation aptly described by Kipling thus:

"They builded a tower to shiver the sky and wrench the stars apart,
Till the Devil grunted behind the bricks: 'It's striking,
but is it art?'
The stone was dropped by the quarry-side, and the idle
derrick swung,
While each man talked of the aims of art, and each in
an alien tongue."

Art involves the representation or reproduction of Nature, the emotions of the artist, and the coördination of both in such products as music, painting, poetry, sculpture, and architecture. Its aim is to substitute a better, richer, more complete and harmonious world for an unsatisfactory or inadequate reality. It is the result of a demand for a fairer creation than that which actually exists, the ideal being one of perfect unity and harmony. Esthetic pleasure is a condition resulting from unity in experience, for if the latter is incomplete it conflicts with other experiences, is discordant, and consequently is not pleasing.

Beauty is a characteristic of varied elements which are unified, complete and harmonious in their effects upon consciousness. According to Paulhan, beauty and art are not equivalent terms though the experiences are often intermingled. Beauty has objective standards but art is primarily an attitude. In discussing the

problem of beauty Münsterberg says: "Corresponding to man's three spheres of experience, to the outer world, to other individuals and to his inner personality, there are different forms of esthetic attitudes. Music expresses the harmony of ourselves, as poetry unveils the harmony of mankind, and fine art the harmony of Nature. In literature the three spheres of influence find expression as epic, drama, and lyric poetry." With the aid of the foregoing discussion, the reader should be able to form fairly definite ideas of the part that color must play in esthetics.

We use color very largely for the purpose of obtaining variety which is so essential to a happy existence. Monotony is ever a monochrome which under continued adaptation becomes colorless. Variety leads us contentedly through a colorful sojourn; monotony condemns us to a colorless existence. It is to satisfy this demand for variety that colors are employed in objects. For the same reason, various colors used harmoniously please more than a single color with the result that we have about us many colors in rugs, paintings, furniture, wall-coverings, and wearing apparel, which are blended in varying degrees of harmony depending upon the sensibility and skill of those responsible.

It is wrong to consider that such arrangements which give esthetic pleasure are merely beautiful because beauty is also useful. Many of the accessory parts of architecture, the colors of furnishings, etc., are primarily ornamental, but they are also useful. The truth of this statement is realized if we pause and imagine all the beauty suddenly eliminated from the world leaving us to live in an environment consisting of the manifestly useful. It may appear that this is a digression from the subject but these aspects cannot be too strongly emphasized before beginning a discussion of the esthetics of color. These arguments apply equally well to all things capable of providing variety which is so essential in producing esthetic pleasure. Color is one of these.

The esthetic significance of color was recognized many centuries ago. Xenophon, in the *Memorabilia*, reports a conversation between Socrates and Parrhasius in which the esthetic value of color is shown to have been appreciated by the early Greeks. [Plato also discusses the beauty and symbolism of color and reveals his acquaintance with its ability to excite emotional responses.] Plotinus and other early writers also touched upon color as an element of beauty. However, not until a compara-

tively recent period has color been discussed sufficiently in connection with esthetic principles to be helpful to any great extent. Allen, Darwin, Fechner and others have tried to account for the esthetic value of color by means of association and various factors which influence the survival of the individual and the species in the evolution of the race. Notwithstanding all that has been written there is only a scanty literature which treats of the esthetics of color apart from the theories of esthetics.

In discussing the part that association plays in esthetics Baldwin says: "As an esthetic principle, association is used to explain esthetic value by deriving the pleasure felt in the presence of the beautiful or sublime, not directly from the form or constitution of the object as such, nor from the sensation it excites, but from the recall or revival of pleasure previously experienced in connection with the same or a related object or quality; e. g., red cheeks suggest youth and health, and are beautiful; red hands suggest disagreeable labor, and are ugly." The same idea can be applied in many of our encounters with color.

Beauty in color appears to depend upon the taste and intellectual development of the beholder; in fact, upon his state of civilization.

Primitive beings prefer gaudy and brilliant colors about them, while intellectual and cultured beings choose the subdued tints and shades. However, there is evidence that our taste for color alone differs little from that of the child and savage. When the influences of environment and association are minimized or eliminated entirely we prefer pure colors more than the tints and shades; that is, the pure colors are most agreeable. This is seen to coincide with the preferences of primitive intellects and indicates that after all there may be little difference between the absolute experiences of human beings.

Our use of colors in the decoration of things about us does not coincide with the preferences which we exhibit for colors viewed apart from ordinary environment and in the absence of association. In civilized art, colors are subdued, the tints and shades, rather than the pure colors, occupying the predominating areas. It is only possible to account for this difference by attributing it to the influences of environment and association. After all, is not the difference between the primitive and the highly civilized being represented in their respective abilities or tendencies to connect various experiences by what we term association? If this argument

is sustained, it is indeed very interesting and important to be able to conclude that the absolute experiences of color are not greatly different for beings of all degrees of civilization. Systematic experiments on color preference with primitive beings would be of interest from this viewpoint.

Although, in general, pure colors are always more agreeable than slightly saturated colors, it is contended by some that green and violet reach their highest degree of agreeableness when not fully saturated. Field has stated that those colors which are naturally of high luminosity have their greatest beauty in their lighter tints, and those which are naturally of low luminosity are most beautiful when highly saturated. Experiments do not indicate this to be true, although there appears to be a tendency in this direction as will be seen by the data on color preference presented in another chapter. These data on color preference which have an intimate relation with the esthetic aspect should be considered in connection with the present discussion.

Color, to be most effective generally, must occupy large areas. In a natural landscape the colors which occupy relatively large areas of the visual field usually have the greatest in-

fluence upon most persons. It is true that small spots of brilliant color usually attract the attention owing to the extreme contrast, however, these are usually lost in the general view. Similarly in interior decoration or in a painting the general color scheme is particularly influential and lasting in the memory of the beholder. The roving eye may be halted momentarily by a relatively small spot of different color but the latter usually will be quickly forgotten as the eye passes on. It serves chiefly as a punctuation mark in enabling the beholder to appreciate the general tone of color. In other words, in the esthetics of color all the colors of the ensemble play parts but these differ considerably from each other depending upon the areas involved as well as upon the colors themselves. Therefore esthetic pleasure, in most cases, is the result of the entire ensemble in which the colors of the predominant areas are most directly influential.

Color is seen at the same time as form but form is usually revealed by light and shade to a much greater extent than by color. The general office of color is to supply the drapery. It aids to a relatively slight degree in revealing form, but serves chiefly in imparting an agreeable aspect to objects, in augmenting relief to

some extent, and in many cases in providing the variety so much evidenced in our desire to have patterns in wall coverings, rugs, and other surroundings.

The esthetics of color arrangement can be studied experimentally with convincing results, however, this is the work of the trained investigator. Painters, decorators and others whose work primarily involves the esthetics and harmony of color may contend that such work lies entirely within their province but such is not the case. These artists have the ability to harmonize color in a resulting unity which gives esthetic pleasure but if they attempt to write the formulæ by means of which harmonious results can be obtained their descriptions often become so involved and swamped in words as to leave the reader bewildered. This is the natural result of attempts to draw conclusions from specific practical cases in which the many factors have not been controlled.

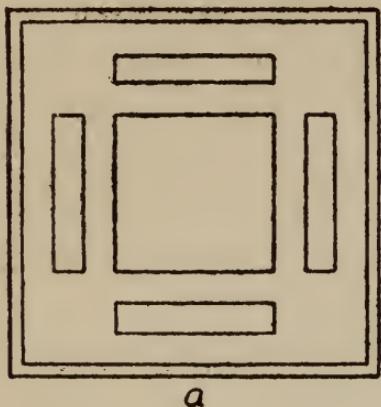
For this reason many artists contend that, aside from a few general principles of color harmony, the realization of satisfactory color arrangements depends upon an esthetic instinct. The attitude of science is naturally that the facts of esthetics are discoverable. In the presence of knowledge mysteries of yesterday

become commonplace simplicities to-day, but knowledge consists merely of the orderly separation and coördination of simple facts. It is true that, in order to produce an esthetic arrangement of colors, a degree of feeling and that which we may call instinct, must be possessed by the successful artist. Esthetic instinct is doubtless an unconscious possession of certain knowledge which it is the aim of science to analyze.

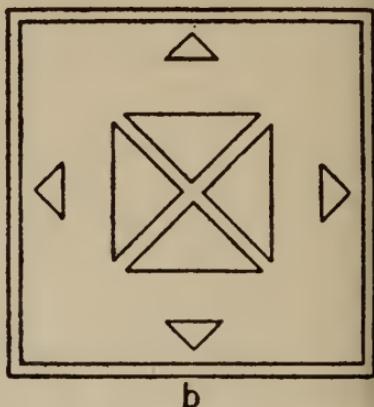
There are few analytical data available which shed light upon the problem of the esthetics of color. Like many other problems discussed in this book, this is included in the unexplored region which must be invaded eventually by the psychologist. That the problems can be attacked successfully by controlled experiments upon a large group of subjects has been shown by the results already obtained in the few scattering experiments. In order to illustrate a case and to present the data which were obtained, an investigation by Miss Kate Gordon on the esthetics of color arrangement will be discussed.

The problem was suggested by one of the many questions which arise in the use of color, this one being as follows: "In massing colors on a canvas is there any general reason for

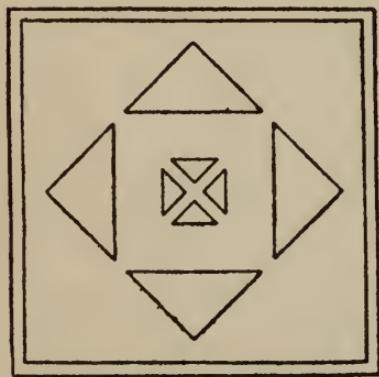
placing certain colors near the center and others near the outside?" She used various symmetrical designs, and it is thus seen that other



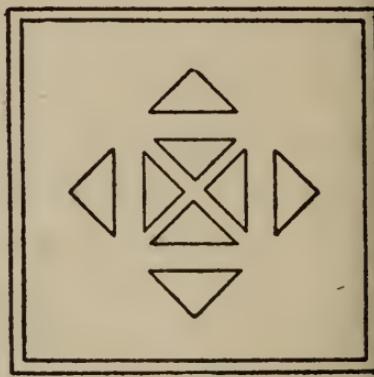
a



b



c



d

Fig. 5. Patterns used by Miss Gordon.

factors besides color must be contended with even in controlled experiments. Form is almost always an accompanying factor from which there is no escape. Certain problems of symmetry entered the problem which will not be

discussed here. In Fig. 5 are shown the designs used in the experiments. Preliminary tests were made with colors arranged as in design, *a*, in which a central square was surrounded by four rectangular areas, the total area of which equaled that of the central square. One color occupied the central square and another the rectangular areas. This design proved unsatisfactory because the figure as a whole was uninteresting and ungraceful and because the central color was disliked on account of its unbroken mass. It was necessary to introduce more complexity into the design in order to obtain an unquestioned esthetic relation.

The researches of Pierce and of Puffer indicated that, since colors of different brightness were to be used, a contrast of small and large masses would be desirable. The colors used were highly saturated red, yellow, green and blue and these were illuminated by daylight. The chief designs used are shown in *b*, *c*, and *d*. In *b* and *c* it is seen that the outer and inner triangular areas were merely reversed; in *d* these were of equal areas. In all cases, sets of observations were made with two different colors, occupying the inner and outer triangles respectively. In the next set the colors were exchanged. Six combinations of colors were

used, namely, blue-yellow, red-green, blue-red, green-yellow, blue-green, red-yellow.

The background was varied from nearly black to a light gray for corresponding complete sets of combinations. In a single set of experiments four frames were used, two of design *b* and two of *c*. These four frames containing only two different colors were presented to each observer simultaneously. Thus for a given case the observer saw blue in the center of design *b*, and yellow in the outer triangles and also in the same design yellow in the center and blue in the outer triangles. The same was true of the other two frames containing design *c*. After the frames were presented to the observer the subjects were not restricted in any way in their choice of the most esthetic arrangement. They were merely asked to record the preference order. The subjects were groups of young women (college students) varying in number.

It was found that the choice of colors for the central regions seemed to be a function of their brightness and further experiments were conducted with the two colors of approximately equal brightnesses. Design *d* was used, thus eliminating the factor of unequal area as well as that of unequal brightness, for the triangles

in this design were of equal areas. The total number of preferences for designs having red in the center were 72; yellow 59; green 45; blue 28. The preference for the warmer colors in the center was very marked in all combinations of color for these patterns.

A summary of the interesting results is as follows:

(1) When large and small masses of color appear together it is more agreeable to find the large ones in the periphery of the visual field.

(2) Brighter colors are preferred near the center of such figures and darker ones near the periphery, whether the background of the colors is light or dark.

(3) In figures where central and peripheral masses are equal in size, and where a light background is surrounded by a black frame, a dark color is preferred in the center.

(4) There is probably some tendency to prefer large masses of a favorite color, but this tendency does not prevail over other considerations.

(5) When colors are equated in brightness the color which stands nearer the red end of the spectrum is preferred in the center.

Obviously these results are strictly applicable only to the designs used, but their usefulness

can be extended to some extent with safety. The results are not only interesting in themselves, but also in general as an illustration of the vulnerability of the problem of the esthetics of color. Obviously a great number of experiments must be performed before the general laws of the esthetics of color are laid bare. The field is inviting to the investigator and is one that promises to yield much of interest. The accumulation of such knowledge does not jeopardize the usefulness of the artist, for his fine sensibility and creative ability must always be depended upon to supply the beautiful arrangements of color. However, science is curious, and this curiosity is responsible for much of the progress of mankind. It is hoped that the artist will welcome such investigations because knowledge will do no harm. In the meantime the artist can progress as he has in the past.

HARMONY

WE enjoy color independently of design or of association with the object upon which it occurs, but usually most of our pleasure derived from color is dependent upon the spatial relation of various colors viewed simultaneously. When an arrangement of colors is pleasing it is said to be a color-harmony. Why certain combinations of colors are agreeable and others are disagreeable or even shocking to the finer sensibilities is a question which is yet to be answered. It is the aim of this book to contribute slightly at least toward the answer to this question but the available knowledge of the psychology of color dwindles almost into insignificance when it is approached with the purpose of seeking an answer to this and many other questions. There is no doubt that contrasts of hue, of brightness and of areas, as well as symmetry, balance, and arrangement in general are important factors in the appeal of combinations of color to the human sensibility. Furthermore, association, environment, training, temperament, and, perhaps, heredity are influences of more or less importance.

In most discussions of the harmony of color certain laws of harmony are presented. These are usually the identical, or slightly modified laws which were enunciated by Chevreul, the French chemist, who, in his life of more than one hundred years, contributed much experimental data of interest in the combination of colors. These laws, however, are meant to be mere guideposts and are not to be taken as distinct boundaries of the different classes of color-harmonies. In fact, a given harmonious arrangement may not be in accordance with any single principle, but is likely to involve more than one. No simple laws of color-harmony can be framed which will be separated by distinct boundary lines. Furthermore, when other factors are considered such as the indefiniteness of the nomenclature of color, the indeterminateness of individual taste, and the meagerness of data, it must be concluded that these laws of color-harmony can be viewed at present only as general statements. They will not become more specific until the accumulation of knowledge has made this simplification possible and doubtless will never be expressible with exactitude. It is not intended that the foregoing statements should discourage the use of these general laws, or the establishment of

others as the knowledge of color-harmony accumulates, but they should serve to caution those who take these laws too seriously at present.

The difficulty which is met in pressing the use of laws of color harmony too far is exemplified by considering the tastes of the savage and of the civilized being. An arrangement of color which delights the former is likely to be considered garish by the latter. On the other hand, the coloring of a Corot, Whistler, or Turner will please the civilized being, but will be found unsatisfactory or uninteresting by the primitive being. A color-harmony must arouse a feeling of completeness. In the foregoing cases the color arrangements may not transgress the laws of harmony, but still may be unsatisfactory, incomplete, or unharmonious depending upon the taste of the beholder. It may be considered folly to judge the laws of color-harmony enunciated by civilized man by means of the judgment of the savage. However, this illustrates the relation of taste to the problem and, inasmuch as civilized tastes vary so widely, that of the savage may be considered as merely one extreme.

Inasmuch as certain phenomena of color, such as the spectrum, figure prominently in discus-

sions of the harmony of color, it is of interest to consider how far such phenomena which are associated more particularly with the science of color can be depended upon in forming a basis for the laws of color-harmony. The artist does not generally avail himself sufficiently of the aid which science can render, yet when he does attempt to do so he is likely to err owing to a lack of an intimate acquaintance with various related aspects of the subject. Science would attack the subject of color-harmony by initiating a painstaking study of various combinations of color with many human subjects and the experiments would be subjected to all the controls possible. This is investigation. However, when the artist grasps certain phenomena, such as the sequence of colors in the spectrum, or certain relations such as complementary colors upon which to base his laws of color-harmony, he is working largely in an opposite direction. He connects his ideas of color-harmony or taste for color-arrangement with these phenomena. In such a procedure he is investigating to some degree, but he is chiefly theorizing. An open mind will consider the harmonious effects of color not to be necessarily related to the sequence of spectral colors and to other facts which are accidental as far as the

human intellect is concerned. If, however, there appears to be a relation between the colors which produce harmonious combinations and the arrangement of the colors in the spectrum, the complementary colors, or any other fact of the science of color, these can then be united as a foundation for laws or theories. The important point is that this relation must be first established by a consensus of opinion of those qualified to pass judgment. Certain relations of this sort appear to be evident and, therefore, the statement of laws based upon them is justifiable.

Chevreul divided color-harmonies into two general classes, namely, harmonies of analogous colors and harmonies of contrast, and each of these he sub-divided into three kinds. He used the words "tone" and "scale," so it appears best to retain them in the statement of these laws, but to explain what he meant by them. The tones of a color (a pigment) designate the different modifications which that color, taken at its maximum purity, is capable of receiving from the addition of white (which weakens its tone) and of black (which deepens it). The term, therefore, includes both tints and shades. The word "scale" is applied to the collection of tones of the same color thus modified. The

pure color is the normal tone of the scale, if this normal tone does not belong to a broken or reduced scale, that is, to a scale all the tones of which are altered with black.

The laws of color-harmony as originally enunciated by Chevreul are as follows:

Harmonies of Analogy.

1. The harmony of scale, produced by the simultaneous view of different tones of a single scale, more or less approximating.

2. The harmony of hues, produced by the simultaneous view of tones of the same height (degree), or nearly so, belonging to scales more or less approximating.

3. The harmony of dominant hue, produced by the simultaneous view of different colors assorted conformably to the law of contrast but one of them predominating, as would result from seeing these colors through a tinted glass of this dominant hue.

Harmonies of Contrasts.

4. The harmony of contrast of scale, produced by the simultaneous view of two tones of the same scale, very distant from each other.

5. The harmony of contrast of hues, produced by the simultaneous view of tones of different height, each belonging to contiguous scales.

6. The harmony of contrast of colors, pro-

duced by the simultaneous view of colors belonging to scales very far apart, assorted according to the law of contrast: the difference in height of juxtaposed colors may also augment the contrast of colors.

It is seen that these laws are only meant to be very general by the looseness of their construction. Each deals with a specific relation, but the limits of its jurisdiction are not and cannot be accurately defined. Harmonies encountered in practice will be found difficult to analyze exactly in terms of a single law and in the case of more than one law being involved it is impossible to analyze them with accuracy. However, these six laws are extremely useful in practice and in analysis and both science and art owe a debt of gratitude to Chevreul for injecting a degree of systematic procedure into the arrangement of colors into harmonious combinations.

The author refrains from departing from a general discussion of this subject or from the treatment of color-harmony as related to science or to fairly well established laws and principles, because the only remaining procedure would be to expound his own ideas of color-harmony. The latter treatment would merely add one more opinion to those already expressed by

others who have written upon the same subject. The present need is not for another dissertation upon a single individual's idea of color-harmony which would include descriptions of specific arrangements of colors. If a description of such arrangements, which were approved by a large majority of persons capable of passing judgment, could be presented it would be a valuable contribution. In fact it would be possible from these to construct more specific laws of color-harmony. A general criticism of the writings on this subject is that they represent in most cases largely the ideas of individuals and often these are interwoven with a great amount of very bad theory. It has been the aim throughout this book to remain as close as possible to indisputable facts or, at least, to ideas that are generally accepted as sound.

If the spectrum be closely observed it will be seen to represent a sequence of hues blending into each other with imperceptible nuances. For this reason it is logical to use it as a portion of the foundation of laws of color-harmony based on analogy, however, the purples must be accounted for in some manner because they do not exist in the spectrum. This is easily accomplished by bending the spectrum (in the imagination) around the circumference of

circle permitting it to occupy, say three fourths of the periphery. The remaining gap between the violet and red is then filled with the purples, the violet-purple being next to the violet and the red-purple adjacent to the red portion of the spectrum. This has been called the color-circle and has formed the basis of many discussions of color-harmony. It is seen that any small portion of the circumference is occupied by a sequence of colors differing only slightly in hue.

Various solids such as the sphere and modifications of it have been used to provide places for the tints and shades as well as for the pure colors and these solids have played conspicuous parts in developing rules for color-harmony. Such efforts are very commendable because they rescue the application of color from a condition of anarchy and provide at least a systematic procedure for the use of color. It is needless to illustrate these here because they can be found elsewhere. It may be of interest to note that in the case of the color-sphere the equator is in reality the color-circle composed of the spectral hues and the purples; the poles are respectively white and black; the polar axis represents a scale of grays; tints occupy one hemisphere and shades the other.

If the color-circle be drawn as described above it will be seen that various diameters have, at their ends, colors which are approximately complementary. This diagrammatic fact is also incorporated into rules of color-harmony based upon the color-circle or the color-sphere. Incidentally, it is fairly well accepted that complementary colors under certain conditions are harmonious combinations especially when one color is used sparingly in area relative to the area occupied by the other.

In experiments conducted by the author on color preference with a group of subjects with fifteen fairly pure colors, the subjects were asked to pair the colors in the most pleasing combinations and to indicate their preference order. For example, the colors, which were each four inches square, were spread upon the table and the subject was asked to choose the most agreeable pair, completely eliminating, if possible such factors as association. After the pair was noted the colors were placed again among the others and a second choice was made, no restriction being made upon the number of times a color could be used in successive combinations. This was continued until each subject had made a list of ten choices in the order of preference. On inspecting these data it was found that about

fifty per cent. of the chosen combinations were approximately complementary and in very few choices were the two colors closely related in the spectrum or color-circle. Such data will eventually provide a sound basis upon which to construct certain laws of color-harmony, but only meager data are available at present. It is true that our ordinary uses of colors are modified by environment, pattern, spatial relation and many other factors so that such data are not directly applicable to practice. However, the conclusions reached from ordinary usage of color are equally open to criticism because of the many uncontrolled factors involved. In fact, we must ultimately take into account the data obtained from both sources and in the meantime hope that critical analysis will be applied to the conditions in all cases which are studied.

A large number of color-charts designed as foundations for color-harmony, when used in accordance with certain rules accompanying them, are available to those interested in this aspect of color. Some of these are very commendable and doubtless have served both the student and artist very well. Most of these are based on the color-circle or on the color-sphere more or less modified. These are simple and

readily understood because they are based on sequences in hues, tints and shades and upon the complementary colors. Some colorists have gone so far as to apply quantitative formulæ to the construction of color-harmonies—a hazardous and confusing procedure when it is considered that there are hundreds of pigments available in the market.

Many of these schemes contain a great deal of unsound reasoning. For example, Field attempts to demonstrate the proportional powers of colors numerically and gives formulæ for combining colors harmoniously. These rules are open to criticism from many viewpoints. Colors are not specifically designated when given merely a name such as red. There are many red pigments available and their spectral compositions vary so widely that far different results are obtained when mixed with another color. Furthermore, it should be remembered that pigments when mixed involve the subtractive principle of color-mixture but colors when viewed involve, to a degree at least, the additive principle. It is futile to attempt to criticize these various methods. Instead it is recommended that those interested in the application of color, study the science of the subject and they will then be able to judge the various pro-

osals for themselves. There is much of value in many of them, but none can be satisfactory unless it conforms to the facts of the science of color-mixture and of various other aspects.

The great colorists were well acquainted with the science of color. The writings of Leonardo da Vinci contain many pleas for a greater understanding of this aspect of color on the part of those engaged in the artistic use of color. This was recognized by such men centuries ago when the science of color was not well understood. To-day the physics of color is well developed so that colorists now have a great advantage over those of past centuries. The attitude of the experienced and successful colorist is expressed by Mengs as follows: "I know not if lessons on coloring have ever been given, notwithstanding it is a part so principal that it has its rules founded on science and reason. Without such a study it is impossible that youth can acquire a good taste in coloring or understand harmony." The author can supplement this from his own small acquaintance with artists, for those who are interested in and familiar with the science of color make excellent use of this knowledge in their application of color both in painting and in decoration. It is unfortunate that students of color-harmony are

not more seriously encouraged to study the science by giving them the opportunity to view some of its wonders at the beginning of their career in color.

Field and others have proposed that a combination of colors is harmonious when the colors are opposed to each other in "equivalent proportions chromatically, or in such proportions as neutralize their individual activities. Some have carried this idea so far as to contend that a color-combination is harmonious when the combined sensations of the different colors would produce a neutral gray if they could be summated. A little reflection shows that this is incorrect for most "harmonies of analogy" would thus fail to be harmonies. None who possesses a fair knowledge of the science of color, will be misled by the many incorrect premises found in such writings.

Nature is sometimes taken as the standard chart of color-harmonies and incongruities in its color-scheme, as viewed from a particular hypothesis of color-harmony, are excused and explained in some manner. Doubtless our aesthetic taste has been greatly influenced by our natural environment but it is unnecessary to believe that Nature's color-schemes are invariably faultless. We are sentimental toward N

ure and are likely to draw upon sentiment in our defense of these incongruities. This results in conclusions which are obviously of doubtful value.

On the other hand, as many mistakes are made by a purely superficial analysis of the colors employed. For example, blue and green would not often be chosen as a harmonious combination, nevertheless, this is perhaps the most conspicuous combination of color in Nature represented by the great juxtaposed areas of blue sky and green vegetation. If the analysis stopped here Nature would be charged with poor taste. However, the sky is a great many times brighter than the green foliage and it is a tint of blue and often a very light one. Furthermore, this tremendous brightness contrast throws the green of the vegetation into a very dark shade so that the simple statement of blue and green in contrast does not describe the combination adequately. Likewise the pink rose in contrast with its green foliage does not fully describe the combination. The rose petals are found to be colored with a variety of tints and the green leaves are a dark grayish green. Thus it is seen that careful observation and description is essential for drawing correct conclusions.

The analogy of music has been used to great extent in the discussion of color-harmony. Such terms as tone, key, pitch, quality, and others have been borrowed from the terminology of music. This comparison of color-harmony with music has been helpful, because of the indefiniteness of the nomenclature of color, but it has also misled some far afield because of their failure to recognize that an analogy cannot be pressed too far. For instance, McDonald attempted to base a system of color-harmony on the musical scale and the laws of the harmony of music. If this could be done it would be mere accident, but McDonald would have abandoned the attempt if he had stopped to think that the ear is analytical while the eye is synthetic in its operation. There are many other reasons why such an attempt was doomed to failure, but this one is so overwhelmingly convincing as to require no other support in condemning such attempts as relating the harmonies of colors and sounds.

Two tones struck simultaneously are not synthesized by the ear, but are recognized as two distinct tones; however, two colored lights when mixed are synthesized into one which usually appears far different than either viewed singly. As long as McDonald kept his color-

separated his scheme might have borne fruit and it is only fair to state that from this viewpoint his attempt is not without merit. Others who have attempted to produce color-music based upon the analogy of colors and sounds have made far worse blunders and have contributed nothing more, in many cases, than chaos to an already abundant supply. Other facts bearing upon this aspect will be brought out later.

It has been the aim in this chapter to discuss the question of color-harmony broadly and to indicate its possible relations to the science of color. No attempt has been made to record the author's ideas of harmony, but rather to point out a few of the pitfalls and to make a plea for a greater use of scientific knowledge and of searching analysis.

COLOR PRACTICE

IT appears of interest in this discussion of the language of color to touch upon the means for obtaining color and upon some of the principles and results of color-mixture. In the use of color three general methods are available, namely, the additive, the subtractive, and the juxtapositional. The first is that involved in the mixture of colored lights as applied upon the stage and in similar cases; the second is that involved in the use of pigments in painting, dyeing, and color-painting; and the third may be used with either lights or pigments. The various principles involved in these three methods of color-mixture have been much confused by many who practice the art of color.

The primary colors of the additive method are red, green, and blue; that is, a mixture of these colors in proper proportions will produce white light or lights of a vast variety of dominant hues. In other words, if lights of these three colors be permitted to illuminate a white paper the resultant color will be white or any dominant hue depending upon the relative intensities of the three primary components.

For example, red and blue lights when mixed make purple; red and green lights make yellow; blue and green lights make blue-green; and yellow and blue lights make white. The latter case is of interest further because it will be noted that the yellow can be made by mixing red and green so that the yellow-blue mixture which resulted in white is actually composed of the three primary components, red, green, and blue. These are examples of the synthetic process of color-vision. The results of various mixtures of colored lights can only be predicted with certainty when the facts of spectrum analysis and of color-mixture are well known.

The primary colored lights which the author finds satisfactory for general purposes are: a red bordering on the orange-red in hue, a green with a yellowish hue, and a blue made by using an ordinary blue glass or transparent dye corrected with a blue-green glass or dye in order to eliminate the red light which is so commonly transmitted by blue dyes and glasses.

The primary colors of the subtractive method are usually considered to be red, yellow and blue, but there appears to be no justification for considering red to be as "primary" as purple. In fact if the artist or dyer depended only upon these colors he would find that he had

no means of obtaining a rich purple by mixture, therefore purple, yellow and blue are primaries of greater productibility. In fact the so-called red primary of the artist or color-printer is in reality a purple so that the difficulty is due to a misnomer rather than to the use of an actual red pigment.

If it is considered that the resultant color due to a subtractive mixture of two or more colors is that which is common to all the components of the mixture, the result can be readily predicted through an acquaintance with the spectral characteristics of the components involved. The principle of the mixture of pigments can be conveniently demonstrated by superposing colored glasses. In fact, this method is used in practice in obtaining colored lights for use as primaries for the additive method.

If purple and yellow glasses be superposed, red results because this color is the only one transmitted by the two glasses. Blue and yellow glasses when superposed transmit green light, and blue and purple glasses when thus combined transmit blue light. These glasses can be considered as representing microscopic flakes of pigments and thus the principles of the mixture of pigments are readily under-

stood. In such cases the incident light penetrates through some of the microscopic flakes and a portion of it finds its way out by reflection. While penetrating and emerging it undergoes various changes in color by these subtractive processes. However in the mixture of pigments other factors such as body color, transparency, surface color, etc., are involved. The ordinary colors of pigments are the results of the subtractive method; for example, an opaque red object appears red under white light because it has the ability to reflect only the red rays to any appreciable extent. If it is viewed under the illumination from a mercury arc or a blue light it appears black, or nearly so, because no rays are present which it is capable of reflecting to any great degree. It is thus seen that in the subtractive process the tendency is toward black and in the additive process toward white.

The juxtapositional method of color-mixture is an averaging additive method. If a few colors occupying small areas be juxtaposed they will appear of a certain uniform color if the eye is at a distance sufficiently great so that the individual colors are no longer resolved. A simple demonstration is that of painting one end of a pack of cards one color, say red,

and the other end green; on reversing alternate cards and viewing one end of the pack at a short distance it will appear yellow. That is, the alternate fine strips of red and green when unresolved by the eye will appear yellow and the apparent brightness will be a mean of the brightnesses of the components.

This method is that involved in "impressionistic" painting in which, for instance, a yellow color is actually produced by pointilistic application of the various components, namely red, orange, yellow, and green. It is also used in textile manufacture by alternating or systematically grouping differently colored threads, in color-photography and elsewhere. The results are often more luminous than when pigments or dyes are intimately mixed to obtain the desired color for, owing to the lack of high saturation of many of the available pigments and dyes, a necessary mixture results in the formation of a certain amount of gray associated with the resulting dominant hue. In other words, if a brilliant green is desired it is a safer and more satisfactory procedure to use a natural green pigment than to obtain it by a mixture of yellow and blue-green pigments. The most satisfactory colors from the viewpoint of brilliancy are obtained by mixture only when the

hues of the components are closely related to that which it is desired to obtain. Lights of various colors can be obtained by the juxtapositional method though usually not as efficiently as they would be obtained directly. These various methods find many applications in the practice of both the science and art of color.

Certain characteristics of coloring materials should be closely studied. The aniline dyes provide a beautiful array of fairly pure and highly transparent colors. Colored glasses, pigments, dyes, water colors, inks, etc., are valuable tools, all of which have their places in the science and art of color. A broad acquaintance with these is a great aid to those especially interested in any of the aspects of color. The chief characteristics which should be noted in the consideration of coloring elements are durability, depth, body, purity, surface character, transparency, brilliancy, luminosity, richness, and beauty.

The method of applying colors to surfaces is also of importance. For example, if a liquid color be applied by means of an air brush, it will often appear quite different (usually much richer) than when applied by means of an ordinary brush. In the former case when applied

thickly it will be left with a rougher and more porous surface which deepens its hue and increases its purity. Many points of this nature are associated with the application of color and the artist in color cannot fail to profit by an intimate knowledge of the laws and principles of the science of color.

Doubtless the blending of colors has been a difficult technique for the young colorist to acquire. Perhaps in no other single aspect of the art of color is a knowledge of the spectral characteristics of pigments and of the science of color-mixture more valuable. If the spectral characters of the pigments are known, approximately at least, and the principles of the subtractive mixture of colors have been thoroughly grasped no discouraging surprises will be encountered. For example, if red and green are blended the result will not be a gradual change from one dominant hue to the other. In this case a muddy color will be found midway because the result of mixing red and green pigments is a gray with perhaps a suggestion of residual color. In blending colors, whose dominant hues are far apart spectrally, it is necessary to use a color between them which contains components of both colors. For example, in blending red and green pigments, yellow is a

satisfactory color for use with them at the indefinite blended junction. Purple may be used for blending red and violet; white for green and purple; blue-green for green and violet; white for yellow and violet. A study of these suggestions will reveal the principle upon which they are based, that is, the blending color is really a link between the colors which are blended by possessing a color common to the two colors. A valuable aid will be found in the color-circle which has been described in the previous chapter.

It would be an endless task to describe the colors resulting from a mixture of pigments. Certainly practice and a knowledge of the spectral characteristics of the colors at hand are better guides than a cumbersome description of specific cases which at best could not be accurate. Some of the available color-charts are helpful as supplementary guides. The futility of descriptions of the results of mixing pigments is readily exemplified by a few cases. Brown might be said to be produced by mixing an orange-red with black, however, if we examine the many colors that are called brown we find a vast array of them varying greatly in hue. Obviously these are not all produced in the same manner. A bluish-gray can be pro-

duced by a mixture of black and white tinted by means of a small proportion of a blue pigment. On the other hand, it might be produced by a mixture of various colors without black or white, for example, a proper mixture of purple and bluish-green. Coloring elements such as pigments are the tools of those applying color in the arts. An intimate acquaintance with these tools is essential and is assumed to be possessed by those interested in applying the language of color.

The application of color, whether it be in a painting, in decoration, in the lighting of the stage or in the many other places where it has found its way, is successful only when guided by the fine sensibility of the artist. Formula cannot be written which will guide those who do not have a well developed esthetic sense in applying colors to the full extent of their expressiveness. This book and others have aimed to bring to the attention of those who use and enjoy colors, various facts and viewpoints concerning color, but it must ever remain for the artist to play the music of light—colors—just as it is left to the musician to render music. However, colors should be appreciated by everyone possessing the gift of color-vision just as music is appreciated. In the rendering of color

as of music we must depend upon the artist who possesses a fine sensibility, in which sentiment, judgment, taste, and perception are harmonized.

Notwithstanding the admission that the artist must be depended upon to play the music of light he can profit as well as others in keeping in close touch with the language of color. The artist has created a portion of the scanty language of color which is available, but the consensus of opinion of the masses (which is unconsciously expressed) has established the remainder. The enlightened artist knows that colors have certain powers of arousing emotions and to analyze these effects is one of his aims for, with this information he is enabled, as Addison says, "to put a virtue into colors, or to find a proper dress for a passion."

COLOR-MUSIC

RHETORICALLY, colors may be referred to as the music of light, but in pressing the analogy between sounds and colors too far the promising and well-intended efforts of many persons have ended in an entanglement of ridiculous argument. The nomenclature of color is so lacking in standardization that it has been convenient and even necessary to borrow definite words from the well-standardized terminology of the science and art of music. The continued use of such terms as tone, key, pitch, harmony, and scale, has misled many to conclude that there is a close affinity between sight and hearing. This conclusion combined with a scanty or superficial knowledge of the science of sounds and of colors has resulted in the formulation of many ideas regarding relations of sounds and colors which have led many others astray. It is not the intention to deny the possible development of color-music, or an art of mobile color, for it appears to the author that in the same number of centuries which were required to bring music to its present stage it is possible for the art of mobile color to evolve.

into something definite and full of meaning. The aim in the present chapter is to discuss the errors of the past and possibly to suggest the course to be pursued in order that the pitfalls may be avoided.

First let us consider how far it is safe to extend the analogy between sounds and colors. The specific meaning of analogy is a similarity of relations and in Webster's dictionary is found this illustration: "Learning enlightens the mind because it is to the mind what light is to the eye, enabling it to discover things before hidden." From this it cannot be deduced that light and learning operate in the same manner. Thus it is seen that an analogy includes only a resemblance of relations. If the full import of the limitations of an analogy had been universally recognized much confusion regarding sounds and colors would have been avoided. Painting as an art is in the same class with music, but as a science, music is far in advance of the other fine arts. For this reason various terms have been borrowed from the nomenclature of music for the purpose of describing colors and their arrangements in various arts. Thus an analogy has been formulated and has gradually outgrown its legitimate boundaries.

With this analogy as a background many

have misapplied a scanty and inaccurate knowledge of the science of color and of sound with the result that various conclusions regarding color-harmony and "color-music" have been built upon untenable assumptions. Unfortunately, Newton, after his epoch-making experiment in which he revealed the spectrum of sunlight, gave seven color-names to the spectral colors, namely, violet, indigo, blue, green, yellow, orange and red. Speculators have associated these seven color-names with the seven notes of the musical scale. We are able to see more than a hundred different hues in the whole visible spectrum and it was purely accidental that Newton applied seven names to it. Doubtless he applied these names for no other purpose than to provide terms for approximate describing or denoting the various spectral regions. Since Newton's time the name, indigo, has been generally dropped from the series. In fact it is not uncommon to use merely the terms red, yellow, green, and blue as descriptive of the conspicuous spectral colors. When discussing color from the viewpoint of color-mixture it is convenient to use only the names, red, green, and blue.

It is quite unsound to relate the seven colors named by Newton to the seven notes of the

musical scale for various other reasons. A highly important one is the absence of a very conspicuous and appealing color—purple—from this series. Furthermore, it must be recognized that even our musical scale is arbitrary. Our octave consists of a chromatic scale of twelve notes, the smallest interval being a half-tone, but this is not universal. There is no absolute scale and therefore, notwithstanding the present standardization of the musical scale among many peoples, it must be recognized that in developing schemes for color-harmony or for color-music it is dangerous to use a foundation that is not perfectly stable or absolute.

The fact that both sounds and colors are associated with wave-theories has also been used to add to the confusion; however, there are many reasons why this fact cannot be used in connecting sounds and colors. Sounds are propagated in the form of waves in a material medium but light-waves are only *supposed* to be transmitted by a medium which is *assumed* to exist. Furthermore, scientists disclaim any general similarity between sound-waves and light-waves; in fact the two kinds of wave-motion are quite different in character. The wave-theories fit beautifully into the analogy if the latter is not pressed too far but are worthless

in relating sounds and colors fundamentally. A notable difference between the sense of hearing and of sight is that the former is analytic and the latter is synthetic in operation. In other words, the ear is able to analyze a mixture of tones (a chord) into its components, but the eye cannot analyze a mixture of colors. Many examples of the synthetic nature of vision have been presented in preceding chapters. If red and green lights be mixed a yellow sensation results; that is, if a pigment reflected only red and green rays it would appear yellow. Failure to consider this great difference between these two senses has led many into very unsound theorizing.

The affective values of auditory sensations differ very much. For example some very low tones are decidedly unpleasant owing to their intensity or volume and many tones of very high pitch are unpleasant owing to their slight extensity and piercing effect. The affective value of visual sensations also varies considerably for the different colors but to those who would cling to a relationship between sound and colors it may be stated that no such unpleasantness is experienced with colors of extremely long and short wave-lengths respectively as in the case of sounds. Colors are

represented by about one octave, the wave-length of the extreme red being about twice that of the extreme violet; however, sounds that are audible to the human ear are represented by many octaves.

Various attempts have been made to establish laws of color-harmony on the basis of the harmony of sounds. These efforts have usually involved the use of the "similarities" described in the foregoing paragraphs; however, there are some of interest because of the more novel modes of attack. In one case the chief thesis appears to be that harmonic relations are built on the basis of notes whose overtones are most alike. For example, the relation of C to F on the musical scale is found to be the closest and this numeric relation is expressed as $\frac{3}{4}$. The spectrum is conceived to be analogous to the musical octave with the upper note omitted, that is, from C to B inclusive. By then applying the ratio $\frac{3}{4}$ to the wave-lengths of the spectral colors it is concluded that the most harmonious combinations of color result. If the facts of color-harmony bear out this mathematical relation it would be of interest, but even then the relation could be considered not more than an analogy at best. It is difficult to place purple into such a scheme because it does not appear

in the spectrum, however, this color cannot be overlooked as a factor in color-harmony. There are many reasons, in musical theory, why certain mathematical ratios are fundamentally important, but it is difficult to see why analogous conditions should prevail in the visible spectrum which is so much shorter in range of wave-lengths than the range of audible sound-waves.

At this point it may be of interest to note that Helmholtz and others have determined the ratios of the wave-lengths of complementary spectral colors and found no simple relation. Helmholtz found this ratio to vary from 1.2 to 1.34. This variation in musical notation would correspond to the relation of a note and its fourth and to that between a note and its diminished third for the extreme ratios. This is one more fact which condemns any chromatic theory which is founded upon a musical basis.

After having been fore-warned of the dangers of extending the analogy between sounds and colors let us consider the analogy somewhat further within legitimate limits because of the possible guidance which it may afford in prosecuting experiments in color-music. Sounds are given significance in speech by the succession of words comprising a phrase or sentence; in

music by the melody or succession of musical notes or chords. Harmony is due to the co-existence of several concords and music results from a succession of tones. We experience great pleasure from harmony (simultaneity) of colors, but will we ever be able to experience pleasure to a comparable degree by melody (succession) of colors? We can enjoy music without harmony, but will we ever be able to enjoy colors to a comparable degree without harmony, that is, by melody alone? The question can only be answered after extensive experiments.

Such experiments were not possible on an extensive scale until the advent of powerful artificial light-sources which may account for the lack of development of melodies of colors. We enjoy to some extent the play of color on a stage setting or as an accompaniment to the dance if the melody is "well rendered." It need not be discouraging to admit our present inability to interpret completely such a melody of color. Modern music evolved from chaos many centuries ago yet we are still quite ignorant of the philosophy of its representative or allegorical power. The expressiveness of color in painting is perhaps equally as well understood, and in many respects color ranks with music

in relation to our understanding. From such a viewpoint we are encouraged to hope and even to expect that some day mankind will be entertained by the rendition of color-melody in which harmony and rhythm will also be interwoven.

It will be necessary to introduce the element of harmony in a manner which will overcome the non-analytic nature of the visual process. The colors which are introduced simultaneously for obtaining harmony must occupy different positions spatially, but the introduction of rhythm should be no more difficult than in the case of music. Whether or not, in the rhythm of color-music, the time-rates will be comparable in general with those employed in sound-music is a question that cannot be answered at present with any degree of certainty. From various considerations it appears that the rhythmic movements of colors must be slower than those which play such an important part in ordinary music. The richness of colors is often heightened when the images of those differing considerably in hue are permitted to impinge upon the retina at a moderate rate of succession. When this rate is too rapid the colors blend into a resultant color, but doubtless there is a range of speed which is satisfac-

tory for various color-phrases depending upon the hues and brightnesses.

The leading elements in sound-music are rhythm, melody, harmony, tone-quality, and dynamic contrast. In experimenting with color-music these elements must be borne in mind though their relations are likely to be considerably altered to allow for the fundamental differences between the visual and auditory senses. The normal adult person is able to experience more than 10,000 tones and many simple noises and these auditory sensations possess attributes of quality and intensity. Among the latter is that of extensity, a low tone being large and a high tone being small. It has been stated by certain psychologists that there are many points of resemblance between tones and achromatic sensations and between noises and colors. If the latter resemblance is too close the possibility of the development of color-music would be seriously doubted, but it does not appear that this is true.

We need only to consider ordinary music to reach the conclusion that rhythmic experiences are much more agreeable than those which are non-rhythmic. Irregularities must be either avoided or compensated. The human organism

seems to demand a certain degree of rhythm and it is noteworthy that many natural phenomena, bodily processes, and human activities are rhythmic. It is possible that these account for our appreciation of psychological rhythm. It should be noted, however, that a sudden turn in a line of a sculpture or painting often affords a pleasant surprise or plays the rôle of an accent or emphasis.

Musical tones vary in their quality and this great diversity enriches the harmony. In the myriad combinations of these qualities exists a variety which, with the aid of the other elements, makes music ever pleasurable. Colors also vary in quality and appear to possess similar possibilities. Will the human organism ever be able to adapt itself to an enjoyment of color-music? This is the most important question to be solved by experiment.

In the preceding, colors and sounds have been considered in parallel and the discussion has been aimed chiefly at the possibility of colors affording sufficient pleasure to encourage the development of color-music—an independent art. It is of interest to digress at this point to discuss the possibility of uniting colors with sound-music in a fundamental manner. Experiments of this nature have been made and al-

though the author subscribes heartily to the idea of experiment it is unfortunate that, intentionally or otherwise, the impression has prevailed that these were finished products evolved in the minds of certain geniuses who possess a knowledge of the language of color far superior to those who have given years to its study. The aim of this book is to review the available facts of the language of color and to discuss as clearly as possible the relation that such an art must bear to the science of color. It is hoped that this discussion as a whole will point out these rudiments and a general consistency in the expressiveness of the various colors. Beyond this it is impossible to extend the discussion except for a few suggestions pointing toward the future.

In relating color-music and sound-music many points must be borne in mind. Although it is difficult to apply numerical values to the affective values of colors and to tones, it is possible to form an idea of the emotive value of colors in general as compared to music. A person may experience pleasure at the sight of a single color, a color-harmony, or a sequence of colors, but the degree of pleasure is not comparable with that experienced on listening to a symphony orchestra or even to a piano selec-

tion. If colors are to compete for favor with music when they are rendered simultaneously it appears likely that the colors must occupy large areas—so large that they provide the “atmosphere.” Colors played on a relatively small surface are conspicuous in their feebleness when competing with a musical rendition. From experience it appears that this is a very important point to be considered at the present time.

It should also be noted that many psychological factors must be considered when combining colors with music. The question arises, does color enhance the power of music? Data are lacking which would settle this question although from conversation with persons who have witnessed colors accompanying music, one is led to believe that the value of colors in this rôle is doubtful. However, colors have not been combined with music in the most effective way as indicated in the preceding paragraph and until this is done the combination of colors and music cannot be condemned. Experiments by the author on both small and large scales indicate that colors can enhance the agreeableness of music although other factors were usually present so that no definite conclusion can be reached. Both vision and audition are

stimulated in the case of a dance accompanied by music, but rhythm is the dominant element common to both senses. When music is accompanied by colors this element is also present, but color alone is supposed to be an important factor. In such a case it must still remain an open question whether colors diminish or enhance the power of music.

In closing this discussion of colors and music it is of interest to refer to a scientific investigation bearing upon the subject. Keith has studied the mutual influence of feelings and has presented results of a long series of experiments with two subjects on the hedonic ranking of various colors, tone-combinations, and surfaces actively or passively touched. Twenty-seven tone-combinations and fourteen of each of the other groups were separately given their values in the conventional scale of seven degrees of pleasantness-unpleasantness, after which the members of each group were combined in turn with those of the other groups and assigned values under these conditions. The results indicate that combining colors and tones lowers the agreeableness of both and combining colors and passive touch or tones and active touch raises the agreeableness of both in both cases. For the other combinations the results

were not sufficiently consistent to warrant any conclusions. A few investigations have been performed which would add interesting data if this discussion were broadly extended, but on the whole the data of direct interest are very meager.

FINALE

WHAT is the future of the language of color? The answer depends upon the degree of progress made in several directions. It cannot be denied that its rudiments exist to-day and that there is a general consistency in the interpretations of it by qualified individuals. There appears to be no reason apparent at present why appreciation and understanding of this rudimentary language should not become as prevalent and as definite as that of music. At this point it is well to note that, although music is quite generally appreciated, its representative power is only vaguely understood. As compared with music in this respect the language of color is relatively not extremely vague. Color is perhaps as generally liked to-day as music, but in a less definite manner. In order to extend the use of the language of color it is necessary to learn more of its rudiments and to standardize them, if possible, by consistent usage. It is also necessary that a general understanding of it be attained by mankind before it can be greatly extended. Finally, it must be determined whether or not the human organism

can adapt itself to an art of mobile color in which color plays the overwhelmingly dominant rôle. Experiments are the only means of determining the unanswered questions, but these experiments should be conducted by those having a wide acquaintance with the many aspects of color.

Heretofore color has not played a leading rôle. Line and form have usually produced a setting in which colors have supplied the drapery and atmosphere. If color is given the leading rôle will it, with the aid of such factors as rhythm, be able to please mankind in a manner comparable with music? Again we must resort to thoughtful experiment. Colors please us greatly in painting, in decoration, as an accompaniment to the dance, and in many settings. Often it is the mobile color such as is witnessed at sunset or on the stage that appeals most to us. Experiments should prove whether or not mobile color can be made more effective and finally be able to play a dominant rôle. Some conducted by the author have indicated that a thoughtful rendition of mobile color has the power to please us greatly.

It is interesting to inquire as to what a "color-score" of an art of mobile color would be like. It is too early to give much time to

such speculation but no start can be made in experimenting without first formulating some idea of a simple color-melody. The expressiveness of colors taken individually must be considered first. These might then be woven into a simple melody in which rhythm, both in time and in intensity, would be introduced. So far, definite form need not enter, however upon the introduction of harmony it is impossible to escape from the introduction of form. Colors must be separated in the visual field in order to harmonize them so that this brings up the question of the character and magnitude of the field upon which to play the colors. Tones meet with no such difficulty in sound-music because they can be emitted simultaneously into space. However, the eye, being a synthetical instrument, makes demands which the ear does not. Many possibilities pertaining to methods of producing colors and of displaying them become apparent to those familiar with the science of color. These have been discussed elsewhere and do not fall within the province of this book.

Experiments need not be confined only to mobile color. An obvious means of evolving an art predominantly of color or an art of mobile color is by using color more definitely and powerfully in the many arts in which it is now a

conspicuous though subordinate factor. By basing the uses of color in these augmented rôles upon the sound though meager knowledge of its expressiveness which is available to-day, progress will be made toward that possible goal which experiment alone will be able to reveal if it exists.

It is unsafe to extend this discussion further because we are approaching the realm of speculation. Notwithstanding the hint of speculation that may appear to some in the title of this book, an aim which has been foremost in the author's mind has been to deal only with facts and to enter the field of speculation only as far as the limits of the province of suggestion. Lest the boundaries of the latter be crossed, the discussion for the present will be closed with a brief résumé of the tools available by the futurist in the highest possible development of the language of color—namely, the art of mobile color.

The character of the available material regarding the expressiveness of color has been outlined in this book. Scientific research will doubtless contribute much of interest regarding the emotive values of colors. Experimental research will reveal the most successful methods of presenting colors in order that their full

powers will be exercised. The factors that may be woven into such a possible art are simultaneous and successive contrasts in brightness and in hue, sequences in hue, tints, and shades, rhythm, spatial relations, and many minor factors more or less related. Will a mobile-colorist of the future be able to "blend the fair tints, and awake the vocal string" of approbation?

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Owing to the scope of this subject it is out of the question to give a comprehensive bibliography but these references will reveal others. The textbooks of color and the journals and textbooks of psychology will be helpful to those who wish to investigate further the various scientific aspects of the subject.



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